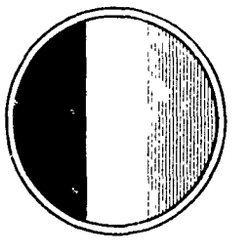

TRASANA

TECHNICAL REPORT NO. 3-78

FLIGHT PROFILE PERFORMANCE HANDBOOK

VOLUME VIID – CH-47D (CHINOOK)

APRIL 1979

DEPARTMENT OF THE ARMY
US ARMY TRADOC SYSTEMS ANALYSIS ACTIVITY
WHITE SANDS MISSILE RANGE
NEW MEXICO 88002

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WARNING

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(9) TECHNICAL REPORT NO. 3-78

(6) FLIGHT PROFILE PERFORMANCE HANDBOOK,

VOLUME VIID, CH-47D (CHINOOK),

PREPARED BY

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(11) APRIL 1979

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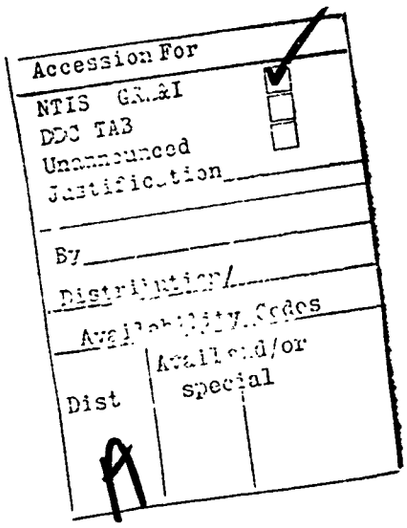
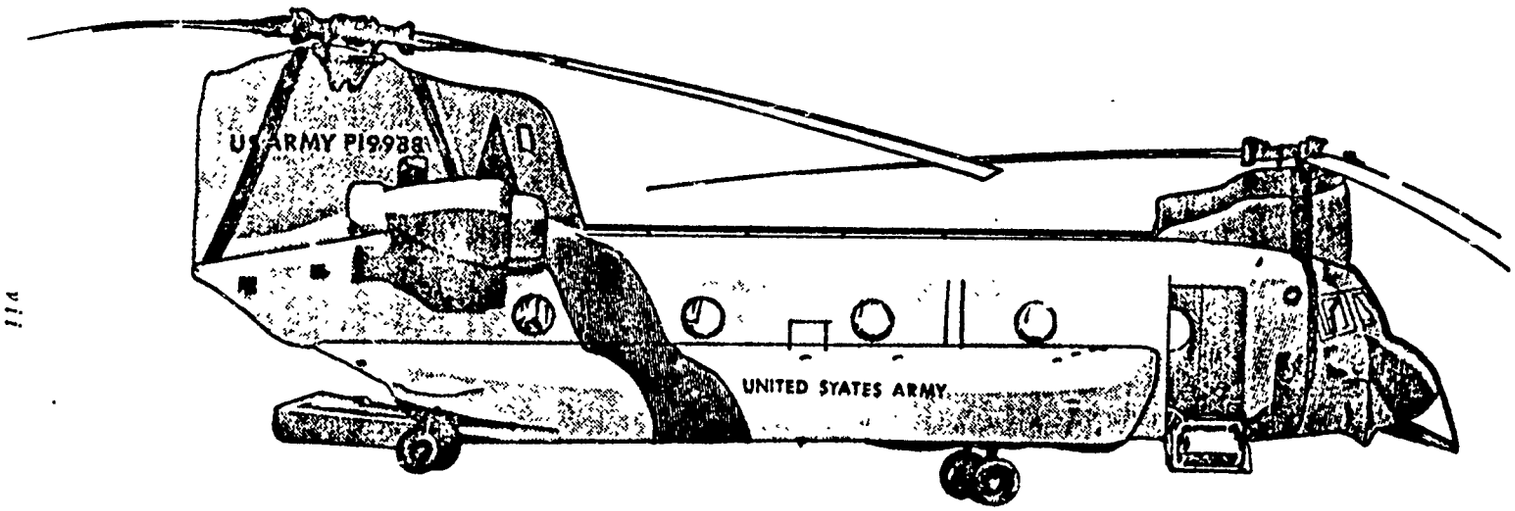
TABLE OF CONTENTS



INDEX OF TABLES AND FIGURES



CH-47 CHINOOK

CHAPTER 1

INTPODUCTION

1. PURPOSE

The purpose for preparing this handbook series is fourfold: (a) to validate CHINOOK performance data quickly, (b) to reduce the manpower and time to prepare accurate flight profiles, (c) to standardize performance data so that the analysis community can benefit from a single reference in conducting studies and (d) to provide a handbook that can be used for training in the mission profile planning area.

2. BACKGROUND

The CHINOOK performance data contained in this Flight Profile Performance Handbook (FPPH) series was originally acquired as a data base for the Aircraft Mission Processing Simulation (AMPS) model. AMPS is a computer program developed by the Aviation Systems Analysis Branch of the US Army TRADOC Systems Analysis Activity (TRASANA) to support Cost and Operational Effectiveness Analyses (COEAs). AMPS generates detailed flight profiles for a wide variety of helicopter missions. The data was provided TRASANA by the Army Aviation Research and Development Command (AVRADCOM) and was the most accurate data available to AVRADCOM at the time of handbook publication. In structuring the data base for AMPS it was noted that the data, when properly organized, could provide a method of doing quick and simple flight profile simulations. This volume presents the CHINOOK data and explains how it can be used.

3. OBJECTIVES OF THE HANDBOOK

a. Data Validation. This volume of the handbook contains tables with the precise performance data and format required to develop flight profiles for computer simulations. Using the handbooks as a reference, the individual project manager (PM) will be able to quickly validate or update as required all associated data contained in the different tables. If this procedure is followed by the various PMs, support of Helicopter COEAs and other analyses can be efficiently implemented.

b. Flight Profile Development. Much of the manpower and time spent in preparing flight profiles for supporting aircraft COEAs is dedicated to look-up, correlation and validation of performance data. Once the procedure contained in this handbook is implemented, flight profiles can be easily prepared. What normally took one man 4 to 5 days to prepare can now be prepared in 3 to 4 hours.

c. Standardization of Performance Data. Each of the PMs has been contacted by AVRADCOM to validate the performance data contained in each handbook in this series. Once each handbook is published, the data contained will be kept current as of the publication date. Since the requests for current information are constantly being forwarded to the PMs by analysis groups, this handbook can be a reference and assure a commonality in studies within the community.

d. Training for Planning Missions and Flight Profiles. For training purposes each handbook can stand alone. It is only a matter of following the example provided and applying the proper data to fit the flight profile desired. Although the example shown is simplistic, the methodology may be expanded to apply to any flight profile no matter how complex.

4. OTHER VOLUMES

This handbook is one of a series that covers the helicopters in the US Army inventory. The complete set of handbooks and their subjects are:

Volume I - FPPH Description

Volume II - UH-60A (BLACKHAWK)

Volume III - AH-1G (COBRA)

Volume IV - AH-1S (COBRA)

Volume V - YAH-64 (Advanced Attack Helicopter [AAH])

Volume VI - OH-58C (KIOWA)

Volume VII - CH-47 (CHINOOK)

Volume VIII - CH-54 (TARHE)

Volume IX - UH-1H (HUEY)

5. GENERAL HANDBOOK DESCRIPTION

a. Performance Data. The data contained in these volumes is CHINOOK performance data compiled from the results of actual experiments. It is not engineering data and is not intended to serve as a base for future helicopter construction or acquisition. The more mature the helicopter becomes, the less likely there will be a change in the basic performance data.

b. Handbook Organization. This volume is one of a series of volumes as identified in paragraph 4 above. Volume I is a description of the methodology used to develop the tables for each of the other volumes. This volume and all other volumes except Volume I provides a simplified flight profile example in Chapter 2. Chapter 3 provides an explanation of each of the five types of data tables contained in the handbook. The five types of tables deal with: (1) Basic Fuel Flow Data, (2) Delta Fuel Flow for Drag Data, (3) Ground Idle Fuel Flow Data, (4) Gross Weight Limits Data and, (5) Velocity Limits data. Chapter 4 contains the actual tables to be used for developing flight profiles.

c. Volume VII Organization. The US Army has four different versions of the CH-47 CHINOOK. Due to the large amount of data for these four versions and to allow for easier reference, there is a separate section of Volume VII for each. Volume VIIA contains data for the CH-47A. In the same manner, Volume VIIB contains CH-47B data, Volume VIIC contains CH-47C data, and Volume VIID contains CH-47D data.

CHAPTER 2

FLIGHT PROFILE EXAMPLE

1. GENERAL

This chapter provides an example of how to develop a flight profile, albeit simple, that can be extended to cover any number of stops, loads and distances all depending on helicopter capability and fuel available.

2. DISCUSSION

a. The main question this example of a flight profile will answer is, "Do I have enough fuel to fly the proposed mission?"

b. Suppose a pilot is to fly a simple resupply mission in a CH-47D CHINOOK helicopter that calls for flying (as shown in illustration 2-1) from point A (the air base), to point B (the pick up area) to point C (the drop off area) and return to A.

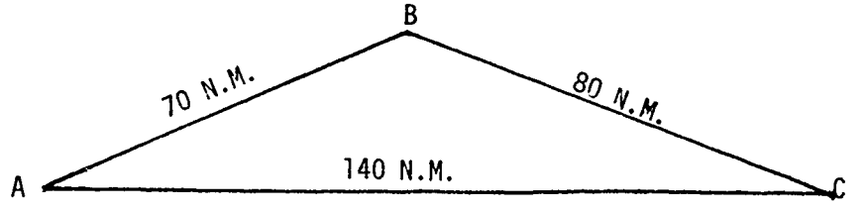


Illustration 2-1

c. The other information given is airspeed (AS) from A to B which is to be 70 knots (kts), from B to C 40 kts, and from C to A 70 kts. The CHINOOK helicopter is to be flown, at 4,000 ft for all legs at an ambient temperature of 15°C, and an idle altitude for take off, pick-up and drop off areas (ground level) of 2000 ft*. The mission plan also shows 10 minutes idle at A before take off, 20 minutes idle at B while loading, 20 minutes idle at C while unloading and 10 minutes idle on return to A before shut down. The CHINOOK will be flown empty at a gross weight (GW) of 26,000 lbs from A to B and from C to A, while the cargo from B to C will be 20,000 lbs.

**All altitudes are in reference to sea level.*

d. The flight plan is prepared by drawing up a table similar to Table 2-1 below. By filling in the blanks under fuel, it can be determined if the total is too large for the helicopter.

TABLE 2-1

Helicopter: CHINOOK (CH-47D)

Altitude: 4000 ft flight/2000 ft idle

Temperature: 15°C

LEG	DISTANCE	AS	TIME	GW (lbs)	FUEL
Idle @ A	-	-	10 min	-	
A-B	70 N.M.	70 kts	1 hr	26,000	
Idle @ B	-	-	20 min	-	
B-C	80 N.M.	40 kts	2 hr	46,000	
Idle @ C	-	-	20 min	-	
C-A	140 N.M.	70 kts	2 hr	26,000	
Idle @ A	-	-	10 min	-	

e. First fill in Idle @ A, Idle @ B, Idle @ C and 2nd Idle @ A since they will all come from Table 2-2. In each case the idle is at 2000 ft and a temperature of 15°C. Consulting the ground idle fuel shown in Table 2-2, the value of 1374 lbs/hr is at the intersection of 2000 ft and 15°C.

1st Idle @ A = 1/6 X 1374 = 229 lbs

Idle @ B = 1/3 X 1374 = 458 lbs

Idle @ C = 1/3 X 1374 = 458 lbs

2nd Idle @ A = 1/6 X 1374 = 229 lbs

TABLE 2-2

GROUND IDLE FUEL FLOW

AIRCRAFT - CH-47D

CHINOOK

		PRESSURE ALTITUDE (FT)					
		SEA LEVEL	2000	4000	6000	8000	10000
TEMPERATURE DEGREES CENTIGRADE	-25 C	1480	1400	1280	1188	1104	1040
	-5 C	1468	1388	1268	1176	1092	1028
	15 C	1454	1374	1254	1162	1078	1014
	35 C	1440	1360	1240	1148	1064	1000

ENTRIES ARE AIRCRAFT FUEL FLOW RATES IN LBS/HR

TABLE 2-3

BASIC FUEL FLOW

FUEL FLOW RATES FOR THE GIVEN CONDITIONS IN LBS/HR

PRESSURE: 4000 FT TEMPERATURE: 15 C

AIRCRAFT - CH-47D

CHINOOK

GROSS WEIGHTS (LBS)	FLIGHT MODE (KTS)									
	HIGE	HOGE	NOE	40	60	80	100	120	140	160
22,000	1770	1879	1846	1814	1628	1606	1709	1923	2265	2929
26,000	1948	2094	2029	1965	1746	1706	1799	2005	2338	2974
30,000	2140	2330	2232	2133	1887	1822	1902	2096	2430	3041
34,000	2350	2590	2458	2325	2053	1954	2020	2203	2544	3162
38,000	2583	2881	2717	2552	2246	2103	2154	2333	2685	3369
42,000	2840	3214	3028	2842	2455	2279	2307	2490	2865	3677
46,000	3129	3595	3394	3193	2685	2484	2488	2691	3138	4139
50,000	3456	4021	3814	3607	2973	2708	2713	2964	3592	4892

Notice the conversion from minutes to hours. These values must be used because fuel flow is in lbs/hr.

f. The fuel flow for the three legs of the mission are calculated next. The heading on Table 2-1 shows a need for the Basic Fuel Flow data chart for the CHINOOK helicopter flying at 4000 ft and at 15°C ambient temperature. Table 2-3 contains the necessary information.

(1) Leg A-B is at 70 kts and 26,000 lbs. This is not one of the values given but 60 kts is 1746 lb/hr and 80 kts is 1706 lb/hr. Interpolation gives the value of 1726 lb/hr for a 70 kts airspeed. Since the leg is one hour long:

Leg A-B = 1 X 1726 = 1726 lbs

(2) Leg B-C is at 40 kts and 46,000 lbs. This value is in the table; 3193 lbs/hr. Since the leg is two hours long:

Leg B-C = 2 X 3193 = 6386 lbs

(3) Leg C-A is at 70 kts and 26,000 lbs. This fuel flow rate was computed above to be 1726 lbs/hr. Since the leg is two hours long:

Leg C-A = 2 X 1726 = 3452 lbs.

g. The flight profile can be finished by filling in Table 2-1 as shown in Table 2-4.

TABLE 2-4

Helicopter: CHINOOK (CH-47D)
Altitude: 4000 ft flight/2000 ft Idle
Temperature: 15°C

LEG	DISTANCE	AS	TIME	GW (lbs)	FUEL
Idle @ A	-	-	10 min	-	229 lbs
A-B	70 N.M.	70 kts	1 hr	26,000	1726 lbs
Idle @ B	-	-	20 min	-	458 lbs
B-C	80 N.M.	40 kts	2 hr	46,000	6386 lbs
Idle @ C	-	-	20 min	-	458 lbs
C-A	140 N.M.	70 kts	2 hr	26,000	3452 lbs
Idle @ A	-	-	10 min	-	229 lbs
				Total	12,938 lbs

h. Although only two look-up tables were used for this example, each type of table has several conditions that are changed so that a wide band of performance parameters can be addressed. The discussion on each of the five types of tables is contained in Chapter 3. A succinct description of each of these five types of tables is:

(1) Basic Fuel Flow Data: Gives the rate the aircraft uses fuel dependent on the given flight conditions.

(2) Delta Fuel Flow for Drag Data: Gives the additional rate of fuel flow to be added to the basic rate for external drag.

(3) Ground Idle Fuel Flow Data: Gives the rate fuel is used when the aircraft is on the ground with its engine running.

(4) Gross Weight Limits Data: A check on whether or not the aircraft has enough lift to take off with a given weight.

(5) Velocity Limits Data: Gives the optimum (long range) speed and maximum rates of speed.

CHAPTER 3

PERFORMANCE DATA TABLE DESCRIPTIONS

1. GENERAL

This chapter describes each of the five basic type tables used for developing flight profiles. The variables within each type of table are described as well as how the specific data required can be extracted.

2. BASIC FUEL FLOW DATA

a. The basic rate of fuel flow* is determined by five variables:

(1) Type of aircraft

(2) Altitude (Air Pressure)**

(3) Temperature***

(4) Gross Weight****

(5) Flight Mode

b. In each table (see Table 3-1) within the basic type, the first three variables are held constant for the whole table, i.e., (a) Type of Aircraft, (b) Altitude (Air Pressure) above sea level, and (c) Temperature. These variables are stated at the top of each table.

c. There are eight rows of fixed gross weights: 22,000 lbs, thru 50,000 lbs inclusive at 4,000 lbs intervals. The ten columns are fixed flight modes.

(1) The first column is Hover In Ground Effect (HIGE). HIGE is used for hovers at a height of 10 feet or less and a component of forward flight 10 kts or less.

(2) The second column is Hover Out of Ground Effect (HOGE). This is used for hovers at a height of more than 10 feet.

---

*The basic fuel flow data represents a clean drag configuration with all doors closed, no wing stores, and no external sling loads.

**All altitudes or air pressures are feet above sea level.

***For simplicity, all temperatures are considered to be the average temperature in which the helicopter is operating (Degrees Centigrade).

****Total vehicle weight in pounds.

(3) The third column is Nap of the Earth (NOE). This is defined as all flight for variable speeds from 0 to 40 kts at variable altitudes.

(4) The remaining seven columns are for given airspeeds* (in kts) as the flight mode.

d. There are 24 of these basic fuel flow charts. Each chart is for a different combination of Air Pressure (Altitude) and temperature.

e The Basic Fuel Flow Data is the main table used in simulating a flight profile. For example, assume a pilot's flight path will require 30 minutes of flight at 80 kts airspeed, 4000 ft. altitude, 15°C and a gross weight of 38,000 lbs in a CH-47D helicopter. Using Table 3-1 at a gross weight of 38,000 lbs and an airspeed of 80 kts, the helicopter will use 2103 lbs/hr fuel, i.e., for 30 minutes, 1052 lbs of fuel will be used.

f. The gross weight values selected provide the basic range of load carrying capability for the ten flight modes of the CHINOOK helicopter. Within the gross weight band shown, linear interpolation** is quite accurate for estimating the fuel flow rates.

g. For example, using Table 3-1, if the helicopter's gross weight was 32,000 lbs and if the flight mode was 60 kts, the fuel flow cannot be found directly. But by interpolating between 60 kts, 30,000 lbs - 1887 lbs/hr and 34,000 lbs - 2053 lbs/hr, the basic fuel flow rate for 32,000 lbs is 1970 lbs/hr. In this example, if the helicopter flies in this mode for 30 minutes, 985 lbs of fuel will be used.

h. As altitude and/or temperature changes occur, different tables are used to look up the aircraft's basic fuel flow rate for each leg of the flight path. Care must be taken that the proper table is used.

i. Appendix A contains a set of functions that will give a good approximation of the basic rate of fuel flow.

3. DELTA FUEL FLOW FOR DRAG DATA

a. The delta fuel flow for drag is also determined by five variables:

(1) Type of Aircraft

(2) Altitude (Air Pressure)

(3) Temperature

(4) Drag Surface (Equivalent Square Footage)

(5) Air Speed

All references to airspeeds are to true airspeeds.

***All references to interpolation are linear interpolations. See FPPH, Volume I, Chapter 3 for a discussion on the accuracy of interpolation.*

TABLE 3-1

BASIC FUEL FLOW

FUEL FLOW RATES FOR THE GIVEN CONDITIONS IN LBS/HR

PRESSURE: 4000 FT TEMPERATURE: 15 C

AIRCRAFT - CH-47D

CHINOOK

GROSS WEIGHTS (LBS)	FLIGHT MODE (KTS)									
	HIGE	HOGE	NOE	40	60	80	100	120	140	160
22,000	1770	1879	1846	1814	1628	1606	1709	1923	2265	2929
26,000	1948	2094	2029	1965	1746	1706	1799	2005	2338	2974
30,000	2140	2330	2232	2133	1887	1822	1902	2096	2430	3041
34,000	2350	2590	2458	2325	2053	1954	2020	2203	2544	3162
38,000	2583	2881	2717	2552	2246	2103	2154	2333	2685	3369
42,000	2840	3214	3028	2842	2455	2279	2307	2490	2865	3677
46,000	3129	3595	3394	3193	2685	2484	2488	2691	3138	4139
50,000	3456	4021	3814	3607	2973	2708	2713	2964	3592	4892

TABLE 3-2

CORRECTION FUEL FLOW LBS/HR FOR EXTERNAL DRAG

PRESSURE: 4000 FT TEMPERATURE: 15 C

AIRCRAFT - CH-47D

CHINOOK

		AIR SPEED IN KTS						
		40	60	80	100	120	140	160
DRAG IN SQUARE FEET	50	12	41	97	191	331	543	872
	100	24	82	194	382	670	1110	1793
	150	37	123	292	574	1019	1717	2718
	200	49	164	390	769	1376	2336	3643

b. Like the basic fuel flow tables, there are 24 tables for delta fuel flow for drag.

c. There are four fixed rows of equivalent square feet of drag: 50 equivalent sq ft thru 200 equivalent sq ft.

d. The seven columns are for airspeeds in kts of: 40 kts, 60 kts, 80 kts, 100 kts, 120 kts, 140 kts, and 160 kts.

e. When an external load is placed on the helicopter, the amount of fuel consumed per hour increases. The delta fuel flow for drag tables indicate how much extra fuel consumption to add to the basic fuel flow rate.

f. In the example given earlier, a 30 minute flight at 80 kts airspeed, 4000 ft altitude, 15°C and a gross weight of 38,000 lbs was used. Using the basic fuel flow tables, the basic fuel flow rate was 2103 lbs/hr. Assuming for this new example that part of the load is external and inducing a 100 equivalent sq ft external drag, the delta fuel flow for drag (Table 3-2) shows 194 lbs/hr should be added to the basic fuel flow rate. Thus the basic fuel flow rate becomes 2103 + 194 or 2297 lbs per hour and for a half-hour flight, 1149 lbs of fuel will be used instead of the 1052 lbs figured without an external load.

g. Appendix B contains a function that will give a good approximation of the delta fuel flow for drag.

4. GROUND IDLE FUEL FLOW DATA

a. The ground idle fuel flow rate is determined by only three variables:

(1) Type of Aircraft

(2) Altitude (Air Pressure)

(3) Temperature

b. There is only one ground idle fuel flow table (shown as Table 2-2). The table has four rows of temperatures: -25°C, -5°C, 15°C and 35°C, and six columns of altitudes: Sea Level, 2000 ft, 4000 ft., 6000 ft., 8000 ft., and 10000 ft.

c. The ground idle fuel flow table is used as discussed in the example flight profile in Chapter 2 (Table 2-2). The CH-47D helicopter idling for 20 minutes at 2000 ft. altitude and 15°C, (across the row labeled 15°C and down the column labeled 2000) find the intersection at 1374. Thus, the CH-47D uses 1374 lbs/hr at these conditions and since it is idling for 20 minutes or 1/3 of an hour, it will use 458 lbs of fuel.

d. If the helicopter had only been 1000 ft. above sea level, the consumption rate would be found by interpolating between the sea level rate of 1454 lbs/hr and the 2000 ft. rate of 1374 lbs/hr which would be 1414 lbs/hr. In 1/3 of an hour 471 lbs of fuel would be used.

e. Appendix C contains a function that will give a good approximation of the ground idle fuel flow.

5. GROSS WEIGHT LIMITS DATA

a. Gross weight limits tables are intended to show whether or not the aircraft can safely take off for four sets of criteria. These criteria are defined in the following paragraphs:

(1) Criteria #1 is based on the helicopter using 100% of Maximum Power for take off and having enough power to lift straight up and above ground effect (See Figure 3-1). Once it is in hovering above ground effect level the helicopter begins forward flight until it acquires, transitional lift and is able to climb at 450 ft/min (a desired standard rate of climb) to the desired altitude. This criteria has some risk since the pilot has no reserve power. It has less risk than Criteria #3 but more than Criteria #2 thus it is considered to be "Middle of the Road" risk.

(2) Criteria #2 (Figure 3-1) is based on the helicopter using 95% of Maximum Power for take off and enough power to immediately begin to climb at a rate of 450 ft/min. This is the least risky criteria since the pilot has power in reserve and is still able to climb at a satisfactory rate.

(3) Criteria #3 (Figure 3-1) has the most risk. Using 100% of Maximum Power the helicopter will only hover in ground effect. Therefore, at an altitude of 10 feet or less, the pilot must begin forward flight and gradually increase airspeed to acquire transitional lift to climb. The reasons for its high risk are readily apparent. First, there is no power in reserve. Second, the pilot must begin forward flight at a very low altitude.

(4) Criteria #4. Structural Gross Weight Limits is the total upper limit of gross weight the helicopter can carry under any take off criteria.

b. Gross Weight Limits are determined by four variables:

(1) Type of Aircraft

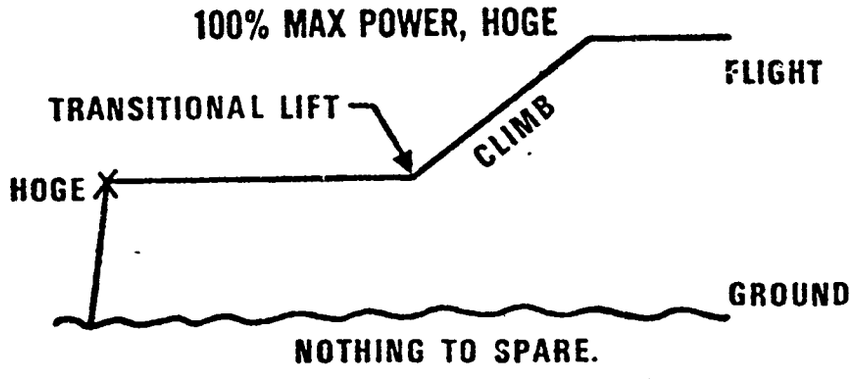
(2) Criteria Chosen

(3) Altitude (Air Pressure)

(4) Temperature

CRITERIA #1

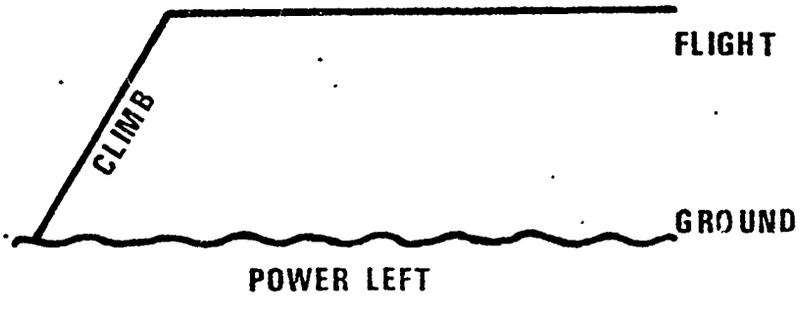
(MIDDLE OF THE ROAD)



CRITERIA #2

(LEAST RISKY)

95% OF RATED POWER. VERTICAL RATE OF CLIMB 450 FT/MIN. HOGE



CRITERIA #3

(MOST RISKY)

100% MAX POWER, HIGE

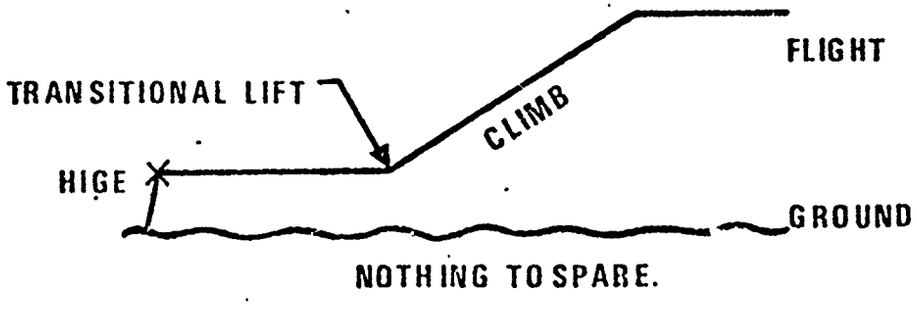


Figure 3-1

TABLE 3-3

GROSS WEIGHT LIMITS

(DUE TO ENGINE)

FOR TAKEOFF CRITERIA #1

100% OF MAXIMUM POWER (HOGE)

AIRCRAFT - CH-47D

CHINOOK

		PRESSURE ALTITUDE (FT)					
		SEA LEVEL	2000	4000	6000	8000	10004
TEMPERATURE DEGREES CENTIGRADE	-25 C	65150	60580	56269	52212	48388	44801
	-5 C	62795	58385	54227	50316	46632	42983
	15 C	57330	53307	49511	45939	42334	39135
	35 C	50606	47053	43703	40221	37174	34312

ENTRIES ARE AIRCRAFT GROSS WEIGHTS IN LBS

STRUCTURAL GROSS WEIGHT LIMIT: 50000 LBS

TABLE 3-4

GROSS WEIGHT LIMITS
(DUE TO TRANSMISSION)
FOR TAKEOFF CRITERIA #1
100% OF MAXIMUM POWER (HOGE)
AIRCRAFT - CH-47D
CHINOOK

		PRESSURE ALTITUDE (FT)					
		SEA LEVEL	2000	4000	6000	8000	10000
TEMPERATURE DEGREES CENTIGRADE	-25 C	57126	55735	54329	52928	51493	50060
	-5 C	55645	54261	52887	51464	50053	48627
	15 C	54278	52916	51521	50127	48725	47247
	35 C	53024	51649	50270	48893	47440	46085

ENTRIES ARE AIRCRAFT GROSS WEIGHTS IN LBS

STRUCTURAL GROSS WEIGHT LIMIT: 50000 LBS

c. Additionally, Criteria #1, #2, and #3 differ due to engine power limits or transmission power limits of the aircraft. Thus there are six tables:

(1) Criteria #1 (Due to engine)

(2) Criteria #1 (Due to transmission)

(3) Criteria #2 (Due to engine)

(4) Criteria #2 (Due to transmission)

(5) Criteria #3 (Due to engine)

(6) Criteria #3 (Due to transmission)

d. The structural gross weight limit is a single value for each helicopter and is only dependent on the type helicopter. The CH-47D structural gross weight limit is given as 50,000 lbs and is listed at the bottom of each table. As the name implies, it is simply not safe to expect the CH-47D structure to maneuver normally when the total weight is larger than that value.

e. In simulating inflight profile, the gross weight limits tables are used to check whether the aircraft is going to be too heavy to take off under the given conditions. As an example, assume the pilot of a CH-47D planned a mission that called for using take off criteria #1 and the take off was to be at 8000 ft., 15°C, and a gross weight of 41,200. Three checks would be required: First, does this gross weight exceed the structural gross weight limit? Second, does it exceed Criteria #1 (due to transmission)? Third, does it exceed Criteria #1 (due to engine)? In the example given, the answer to all three questions is "No", the take off will not exceed aircraft limits. (Tables 3-3 and 3-4)

f. If the assigned gross weight had been 44,000 lbs, it would have exceeded the value given for 8,000 ft. and 15°C at Criteria #1 (Due to engine). (Table 3-3) The mission could not be flown as planned. The plan could be changed, for example to take off at 6000 ft. (which might not be practical) or change to take off Criteria #3 (which is more risky but has higher limits).

g. If the assigned gross weight had been 53,200 lbs., it would have exceeded the structural limits. To perform the mission the only choices would be to lighten the load or get another type helicopter.

h. Appendix D contains a set of functions that will give a good approximation of the gross weight limits for takeoff.

6. VELOCITY LIMITS DATA

a. There are various types of data given in these tables but like the gross weight limits tables, they are primarily restraints on what can be expected of a helicopter in planning a mission profile. Velocity limits tables are influenced by five variables:

(1) Type of aircraft

(2) Air pressure (altitude)

(3) Temperature

(4) Gross weight

(5) Condition or limit

b. Items (1) through (4) are self-explanatory. There are five types of information that can be listed under (5):

(1) Long range

(2) Maximum continuous power

(3) Maximum power (due to engine limits)

(4) Transmission limits

(5) V_{ne} (velocity never exceed)

c. For each aircraft, there are 24 Velocity Limits Tables depending on air pressure and temperature combination. Table 3-5 is an example of the content of the Velocity Limits Table.

d. The two columns under Long Range (Table 3-5) give the optimum speed and fuel flow for each set of variables #1 through #4 above. Thus the CH-47D operating at 2000 ft., temperature 15°C, and having a gross weight of 38,000 lbs will fly a longer distance if the velocity is kept at 141 kts and will use 2825 lbs/hr of fuel at that velocity.

e. Maximum continuous power gives the fastest speed at which a helicopter can fly for long periods (30 minutes or more) and the associated fuel flow rate. An example from Table 3-5 would be a CH-47D at 2000 ft. and 15° weighing 38,000 lbs could fly 156 kts with a fuel usage of 3288 lbs/hr.

TABLE 3-5

VELOCITY LIMITS TABLE

(INCLUDING FUEL FLOW RATES)

PRESSURE: 2000 FT TEMPERATURE: 15 C

AIRCRAFT - CH-47D

CHINOOK

GROSS WEIGHTS (LBS)	LONG RANGE		MAX CONTINUOUS POWER		MAX POWER (ENGINE)		TRANSMISSION LIMITS		VELOCITY NEVER EXCEED	
	VEL (KTS)	F.F. (LBS/HR)	VEL (KTS)	F.F. (LBS/HR)	VEL (KTS)	F.F. (LBS/HR)	VEL (KTS)	F.F. (LBS/HR)	VEL (KTS)	F.F. (LBS/HR)
22,000	136	2321	163	3288	185	4271	184	4229	160	3135
26,000	139	2450	162	3288	185	4271	184	4229	160	3179
30,000	140	2575	161	3288	185	4271	184	4229	160	3231
34,000	141	2693	159	3288	184	4271	183	4229	160	3316
38,000	141	2825	156	3288	179	4271	178	4229	160	3466
42,000	141	2976	151	3288	172	4271	171	4229	160	3701
46,000	141	3162	145	3288	163	4271	163	4229	145	3278
50,000	137	3335	136	3288	157	4271	156	4229	122	2966

f. Maximum power (engine and transmission limits) show the maximum speeds the aircraft can structurally attain for short periods of time (less than 30 minutes). Thus the CH-47D helicopter at 2000 ft and 15°C weighing 38,000 lbs has an engine that is capable of producing enough power to fly 179 kts but the transmission limits the aircraft to 178 kts. Between these two columns then, the flight cannot exceed 178 kts with a fuel flow rate of 4229 lbs/hrs.

g. There is another limiting factor called V_{ne} (velocity never exceed). This velocity limit is determined by helicopter structural considerations. V_{ne}'s are used in the same manner as maximum power limits described in paragraph f above. Since a value of 160 kts is listed for 2,000 ft., 15°C, and 38,000 lbs, this implies that the values in f cannot be reached.

7. DETAILED FLIGHT PROFILE USING ALL PERFORMANCE DATA TABLES

The example of a Flight Profile in Chapter 2 was intentionally simplified to assure clarity. The description of the various tables in this handbook, however, indicates a more complex set of considerations are normally encountered in developing the flight profile. With the description provided in this chapter, additional information should be included in the flight plan beyond that shown in the example and a suggested format is provided below in Table 3-6.

TABLE 3-6

Helicopter:
Altitude:
Temperature:

LEG	DISTANCE	AS	CHECK VELOCITY LIMIT	TIME	GW (LBS)	DRAG	FUEL

Needed for each take off:
Weight at take off:
Type of take off:
Check transmission limits:
Check engine limits:
Check structural gross weight limit:

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CHAPTER 4

CHINOOK (CH-47D) PERFORMANCE DATA TABLES

GENERAL

The following tables are the major information presented in this handbook. If the procedure for using them is understood, a flight profile for the CHINOOK (CH-47D) helicopter can be prepared in a matter of a few hours. The performance data contained have been reviewed for accuracy and are corrected to the best of our knowledge. The tables are organized in the following manner:

Tables 4-1 to 4-24	Basic Fuel Flow Data
Tables 4-25 to 4-48	Delta Fuel Flow for Drag Data
Table 4-49	Ground Idle Fuel Flow Data
Tables 4-50 to 4-55	Gross Weight Limits Data
Tables 4-56 to 4-79	Velocity Limits Data

BASIC FUEL FLOW DATA TABLES

TABLE 4-1

BASIC FUEL FLOW

FUEL FLOW RATES FOR THE GIVEN CONDITIONS IN LBS/HR

PRESSURE: SEA LEVEL TEMPERATURE: -25 C

AIRCRAFT - CH-47D

CHINOOK

GROSS WEIGHTS (LBS)	FLIGHT MODE (KTS)									
	HIGE	HOGE	NOE	40	60	80	100	120	140	160
22,000	1799	1893	1899	1904	1732	1728	1887	2203	2727	3721
26,000	1952	2071	2053	2035	1820	1810	1967	2282	2790	3783
30,000	2117	2264	2219	2173	1921	1902	2054	2365	2864	3872
34,000	2292	2476	2398	2321	2042	2004	2149	2453	2950	3956
38,000	2478	2707	2594	2481	2175	2117	2252	2546	3051	4058
42,000	2677	2958	2808	2659	2327	2241	2366	2653	3167	4196
46,000	2895	3227	3043	2859	2499	2379	2492	2775	3302	4391
50,000	3131	3520	3306	3091	2694	2530	2632	2917	3494	4660

TABLE 4-2

BASIC FUEL FLOW

FUEL FLOW RATES FOR THE GIVEN CONDITIONS IN LBS/HR

PRESSURE: SEA LEVEL TEMPERATURE: -5 C

AIRCRAFT - CH-47D

CHINOOK

GROSS WEIGHTS (LBS)	FLIGHT MODE (KTS)									
	HIGE	HOGE	NOE	40	60	80	100	120	140	160
22,000	1852	1949	1945	1941	1763	1752	1891	2171	2629	3500
26,000	2012	2136	2106	2076	1858	1837	1972	2248	2690	3551
30,000	2184	2340	2280	2220	1968	1933	2060	2330	2763	3601
34,000	2366	2564	2470	2376	2095	2040	2157	2417	2849	3659
38,000	2561	2807	2677	2548	2241	2160	2265	2515	2951	3745
42,000	2772	3070	2906	2742	2408	2293	2385	2626	3072	3881
46,000	3004	3357	3161	2965	2598	2440	2518	2757	3216	4127
50,000	3254	3676	3454	3231	2805	2607	2667	2910	3387	4435

TABLE 4-3

BASIC FUEL FLOW

FUEL FLOW RATES FOR THE GIVEN CONDITIONS IN LBS/HR

PRESSURE: SEA LEVEL TEMPERATURE: 15 C

AIRCRAFT - CH-47D

CHINOOK

GROSS WEIGHTS (LBS)	FLIGHT MODE (KTS)									
	HIGE	HOGE	NOE	40	60	80	100	120	140	160
22,000	1907	2007	1994	1980	1799	1764	1907	2160	2570	3354
26,000	2072	2202	2161	2120	1900	1872	1990	2237	2631	3397
30,000	2251	2418	2345	2271	2018	1973	2081	2319	2706	3443
34,000	2442	2653	2545	2437	2157	2087	2183	2409	2796	3506
38,000	2647	2907	2765	2623	2317	2215	2297	2512	2904	3611
42,000	2871	3185	3010	2835	2501	2358	2425	2633	3034	3784
46,000	3115	3496	3292	3089	2704	2519	2568	2776	3192	4040
50,000	3383	3845	3625	3406	2917	2706	2729	2945	3395	4391

TABLE 4-4

BASIC FUEL FLOW

FUEL FLOW RATES FOR THE GIVEN CONDITIONS IN LBS/HR

PRESSURE: SEA LEVEL TEMPERATURE: 35 C

AIRCRAFT - CH-47D

CHINOOK

GROSS WEIGHTS (LBS)	FLIGHT MODE (KTS)									
	HIGE	HOGE	NOE	40	60	80	100	120	140	160
22,000	1962	2066	2044	2022	1838	1820	1932	2163	2535	3246
26,000	2133	2270	2218	2166	1946	1912	2016	2240	2599	3285
30,000	2319	2497	2411	2325	2074	2019	2112	2324	2677	3332
34,000	2518	2743	2623	2503	2224	2140	2219	2419	2774	3411
38,000	2736	3009	2857	2704	2400	2277	2341	2531	2890	3550
42,000	2972	3306	3124	2941	2599	2432	2478	2664	3032	3770
46,000	3230	3644	3442	3239	2808	2613	2633	2822	3215	4075
50,000	3521	4019	3806	3592	3039	2817	2814	3022	3494	4538

TABLE 4-5

BASIC FUEL FLOW

FUEL FLOW RATES FOR THE GIVEN CONDITIONS IN LBS/HR

PRESSURE: 2000 FT TEMPERATURE: -25 C

AIRCRAFT - CH-47D

CHINOOK

GROSS WEIGHTS (LBS)	FLIGHT MODE (KTS)									
	HIGE	HOGE	NOE	40	60	80	100	120	140	160
22,000	1730	1827	1824	1820	1643	1637	1785	2078	2558	3483
26,000	1889	2012	1983	1954	1737	1723	1869	2159	2626	3546
30,000	2059	2214	2156	2097	1850	1820	1959	2245	2707	3643
34,000	2241	2438	2345	2252	1976	1929	2058	2337	2801	3736
38,000	2435	2683	2553	2423	2122	2050	2168	2437	2912	3861
42,000	2648	2947	2782	2618	2289	2184	2291	2556	3042	4040
46,000	2881	3235	3040	2845	2480	2333	2429	2694	3226	4296
50,000	3131	3564	3337	3110	2691	2503	2584	2854	3430	4636

TABLE 4-6

BASIC FUEL FLOW

FUEL FLOW RATES FOR THE GIVEN CONDITIONS IN LBS/HR

PRESSURE: 2000 FT TEMPERATURE: -5 C

AIRCRAFT - CH-47C

CHINOOK

GROSS WEIGHTS (LBS)	FLIGHT MODE (KTS)									
	HIGE	HOGE	NOE	40	60	80	100	120	140	160
22,000	1782	1882	1869	1856	1674	1661	1788	2048	2467	3274
26,000	1947	2077	2036	1995	1775	1750	1872	2127	2533	3324
30,000	2125	2292	2218	2145	1895	1852	1965	2211	2613	3377
34,000	2315	2527	2418	2310	2033	1967	2069	2304	2707	3449
38,000	2520	2783	2640	2496	2193	2096	2185	2411	2823	3566
42,000	2747	3064	2888	2711	2377	2239	2315	2536	2960	3788
46,000	2994	3377	3173	2969	2582	2402	2461	2685	3126	4082
50,000	3263	3738	3513	3288	2799	2592	2626	2860	3339	4465

TABLE 4-7

BASIC FUEL FLOW

FUEL FLOW RATES FOR THE GIVEN CONDITIONS IN LBS/HR

PRESSURE: 2000 FT TEMPERATURE: 15 C

AIRCRAFT - CH-47D

CHINOOK

GROSS WEIGHTS (LBS)	FLIGHT MODE (KTS)									
	HIGE	HOGE	NOE	40	60	80	100	120	140	160
22,000	1835	1939	1916	1894	1710	1691	1804	2038	2412	3135
26,000	2007	2144	2091	2038	1818	1785	1891	2117	2479	3179
30,000	2192	2370	2284	2197	1947	1893	1987	2202	2561	3231
34,000	2391	2616	2495	2374	2099	2015	2096	2300	2662	3316
38,000	2609	2886	2732	2577	2275	2153	2220	2415	2784	3466
42,000	2848	3188	3003	2819	2474	2309	2359	2552	2935	3701
46,000	3111	3530	3327	3125	2685	2492	2516	2715	3128	4033
50,000	3405	3919	3700	3481	2922	2700	2703	2925	3422	4527

TABLE 4-8

BASIC FUEL FLOW

FUEL FLOW RATES FOR THE GIVEN CONDITIONS IN LBS/HR

PRESSURE: 2000 FT TEMPERATURE: 35 C

AIRCRAFT - CH-47D

CHINOOK

GROSS WEIGHTS (LBS)	FLIGHT MODE (KTS)									
	HIGE	HOGE	NOE	40	60	80	100	120	140	160
22,000	1888	1997	1965	1934	1749	1726	1828	2040	2380	3033
26,000	2067	2212	2148	2085	1865	1825	1917	2120	2450	3074
30,000	2259	2449	2351	2253	2004	1939	2018	2209	2538	3134
34,000	2469	2707	2575	2444	2170	2070	2134	2314	2646	3246
38,000	2699	2992	2830	2668	2363	2218	2267	2440	2779	3439
42,000	2951	3320	3135	2949	2570	2392	2417	2591	2950	3723
46,000	3236	3690	3493	3296	2795	2593	2592	2782	3206	4150
50,000	3556	4099	3894	3689	3074	2812	2809	3043	3631	4848

TABLE 4-9

BASIC FUEL FLOW

FUEL FLOW RATES FOR THE GIVEN CONDITIONS IN LBS/HR

PRESSURE: 4000 FT TEMPERATURE: -25 C

AIRCRAFT - CH-47D

CHINOOK

GROSS WEIGHTS (LBS)	FLIGHT MODE (KTS)									
	HIGE	HOGE	NOE	40	60	80	100	120	140	160
22,000	1668	1767	1755	1742	1561	1553	1689	1961	2401	3259
26,000	1832	1960	1920	1880	1662	1644	1776	2044	2475	3345
30,000	2008	2174	2101	2028	1784	1747	1871	2133	2563	3430
34,000	2197	2410	2302	2193	1921	1864	1977	2229	2667	3541
38,000	2404	2669	2524	2380	2081	1993	2096	2342	2791	3700
42,000	2633	2951	2775	2599	2267	2139	2230	2475	2964	3937
46,000	2880	3272	3064	2857	2476	2304	2382	2632	3161	4266
50,000	3153	3642	3412	3182	2696	2500	2552	2815	3416	4683

TABLE 4-10

BASIC FUEL FLOW

FUEL FLOW RATES FOR THE GIVEN CONDITIONS IN LBS/HR

PRESSURE: 4000 FT TEMPERATURE: -5 C

AIRCRAFT - CH-47D

CHINOOK

GROSS WEIGHTS (LBS)	FLIGHT MODE (KTS)									
	HIGE	HOGE	NOE	40	60	80	100	120	140	160
22,000	1718	1822	1800	1777	1593	1576	1693	1932	2315	3060
26,000	1890	2026	1973	1921	1702	1671	1781	2014	2387	3111
30,000	2074	2252	2165	2078	1831	1780	1879	2102	2476	3171
34,000	2272	2499	2378	2256	1983	1903	1990	2203	2582	3268
38,000	2492	2773	2617	2461	2159	2042	2115	2322	2712	3433
42,000	2735	3077	2892	2706	2360	2200	2258	2465	2871	3732
46,000	2999	3429	3223	3016	2575	2386	2420	2635	3074	4099
50,000	3299	3832	3607	3382	2817	2599	2613	2854	3388	4631

TABLE 4-11

BASIC FUEL FLOW

FUEL FLOW RATES FOR THE GIVEN CONDITIONS IN LBS/HR

PRESSURE: 4000 FT TEMPERATURE: 15 C

AIRCRAFT - CH-47D

CHINOOK

GROSS WEIGHTS (LBS)	FLIGHT MODE (KTS)									
	HIGE	HOGE	NOE	40	60	80	100	120	140	160
22,000	1770	1879	1846	1814	1628	1606	1709	1923	2265	2929
26,000	1948	2094	2029	1965	1746	1706	1799	2005	2338	2974
30,000	2140	2330	2232	2133	1887	1822	1902	2096	2430	3041
34,000	2350	2590	2458	2325	2053	1954	2020	2203	2544	3162
38,000	2583	2881	2717	2552	2246	2103	2154	2333	2685	3369
42,000	2840	3214	3028	2842	2455	2279	2307	2490	2865	3677
46,000	3129	3595	3394	3193	2685	2484	2488	2691	3138	4139
50,000	3456	4021	3814	3607	2973	2708	2713	2964	3592	4892

TABLE 4-12

BASIC FUEL FLOW

FUEL FLOW RATES FOR THE GIVEN CONDITIONS IN LBS/HR

PRESSURE: 4000 FT TEMPERATURE: 35 C

AIRCRAFT - CH-47D

CHINOOK

GROSS WEIGHTS (LBS)	FLIGHT MODE (KTS)									
	HIGE	HOGE	NOE	40	60	80	100	120	140	160
22,000	1822	1936	1895	1854	1667	1640	1731	1925	2236	2832
26,000	2007	2162	2087	2012	1794	1746	1826	2009	2314	2878
30,000	2208	2410	2301	2192	1947	1869	1935	2106	2412	2963
34,000	2431	2683	2542	2401	2130	2010	2060	2223	2535	3122
38,000	2675	2997	2829	2661	2334	2175	2205	2366	2692	3378
42,000	2952	3357	3176	2996	2552	2371	2373	2545	2921	3760
46,000	3266	3759	3568	3376	2822	2587	2583	2794	3318	4412
50,000	3613	4215	4116	4017	3149	2833	2839	3114	3859	5360

TABLE 4-13

BASIC FUEL FLOW

FUEL FLOW RATES FOR THE GIVEN CONDITIONS IN LBS/HR

PRESSURE: 6000 FT TEMPERATURE: -25 C

AIRCRAFT - CH-47D

CHINOOK

GROSS WEIGHTS (LBS)	FLIGHT MODE (KTS)									
	HIGE	HOGE	NOE	40	60	80	100	120	140	160
22,000	1611	1714	1692	1670	1487	1476	1601	1852	2256	3049
26,000	1781	1916	1864	1812	1598	1572	1691	1937	2336	3142
30,000	1964	2142	2056	1969	1727	1683	1792	2029	2432	3238
34,000	2163	2393	2270	2147	1878	1807	1906	2136	2548	3376
38,000	2385	2667	2511	2356	2056	1948	2035	2262	2708	3587
42,000	2629	2977	2790	2603	2260	2108	2183	2414	2896	3896
46,000	2897	3341	3129	2917	2479	2299	2350	2593	3141	4299
50,000	3209	3742	3520	3299	2724	2518	2549	2820	3501	4861

TABLE 4-14

BASIC FUEL FLOW

FUEL FLOW RATES FOR THE GIVEN CONDITIONS IN LBS/HR

PRESSURE: 6000 FT TEMPERATURE: -5 C

AIRCRAFT - CH-47D

CHINOOK

GROSS WEIGHTS (LBS)	FLIGHT MODE (KTS)									
	HIGE	HOGE	NOE	40	60	80	100	120	140	160
22,000	1661	1769	1737	1704	1519	1498	1605	1824	2175	2859
26,000	1838	1983	1919	1854	1637	1600	1697	1908	2254	2912
30,000	2029	2221	2121	2022	1778	1717	1802	2003	2352	2989
34,000	2241	2484	2349	2215	1945	1849	1922	2115	2473	3124
38,000	2477	2778	2612	2447	2140	2001	2059	2250	2622	3388
42,000	2736	3118	2929	2741	2351	2180	2216	2413	2813	3733
46,000	3030	3515	3308	3100	2588	2389	2404	2624	3104	4234
50,000	3372	3941	3738	3536	2881	2620	2638	2907	3620	5002

TABLE 4-15

BASIC FUEL FLOW

FUEL FLOW RATES FOR THE GIVEN CONDITIONS IN LBS/HR

PRESSURE: 6000 FT TEMPERATURE: 15 C

AIRCRAFT - CH-47D

CHINOOK

GROSS WEIGHTS (LBS)	FLIGHT MODE (KTS)									
	HIGE	HOGE	NOE	40	60	80	100	120	140	160
22,000	1711	1826	1783	1741	1555	1528	1620	1816	2129	2734
26,000	1896	2051	1975	1899	1683	1635	1716	1901	2210	2786
30,000	2097	2300	2190	2080	1837	1760	1827	2001	2314	2879
34,000	2321	2578	2435	2292	2021	1902	1955	2121	2443	3051
38,000	2570	2897	2728	2559	2227	2069	2102	2270	2610	3327
42,000	2851	3267	3084	2901	2449	2268	2275	2458	2855	3747
46,000	3173	3688	3493	3297	2728	2490	2494	2721	3281	4455
50,000	3536	4145	4069	3993	3062	2744	2758	3051	3852	5437

TABLE 4-16

BASIC FUEL FLOW

FUEL FLOW RATES FOR THE GIVEN CONDITIONS IN LBS/HR

PRESSURE: 6000 FT TEMPERATURE: 35 C

AIRCRAFT - CH-47D

CHINOOK

GROSS WEIGHTS (LBS)	FLIGHT MODE (KTS)									
	HIGE	HOGE	NOE	40	60	80	100	120	140	160
22,000	1762	1883	1832	1780	1594	1562	1642	1818	2104	2644
26,000	1954	2120	2034	1948	1733	1676	1743	1907	2190	2704
30,000	2167	2380	2261	2143	1902	1808	1861	2014	2301	2825
34,000	2403	2677	2528	2380	2101	1963	1998	2147	2444	3044
38,000	2668	3024	2859	2693	2313	2150	2158	2313	2643	3377
42,000	2975	3416	3238	3061	2568	2362	2358	2545	2999	3962
46,000	3317	3865	3754	3643	2888	2603	2607	2856	3524	4870
50,000	3702	4354	4533	4712	3249	2887	2895	3217	4113	6028

TABLE 4-17

BASIC FUEL FLOW

FUEL FLOW RATES FOR THE GIVEN CONDITIONS IN LBS/HR

PRESSURE: 8000 FT TEMPERATURE: -25 C

AIRCRAFT - CH-47D

CHINOOK

GROSS WEIGHTS (LBS)	FLIGHT MODE (KTS)									
	HIGE	HOGE	NOE	40	60	80	100	120	140	160
22,000	1560	1667	1635	1604	1419	1405	1519	1750	2121	2869
26,000	1736	1880	1816	1752	1540	1508	1614	1839	2208	2954
30,000	1927	2120	2020	1919	1681	1626	1722	1937	2315	3070
34,000	2141	2385	2250	2115	1848	1760	1845	2056	2446	3251
38,000	2378	2683	2517	2351	2046	1914	1987	2200	2637	3531
42,000	2640	3037	2843	2648	2262	2098	2149	2372	2867	3913
46,000	2946	3433	3228	3024	2501	2314	2344	2591	3208	4448
50,000	3290	3857	3658	3458	2805	2550	2585	2920	3736	5250

TABLE 4-18

BASIC FUEL FLOW

FUEL FLOW RATES FOR THE GIVEN CONDITIONS IN LBS/HR

PRESSURE: 8000 FT TEMPERATURE: -5 C

AIRCRAFT - CH-47D

CHINOOK

GROSS WEIGHTS (LBS)	FLIGHT MODE (KTS)									
	HIGE	HOGE	NOE	40	60	80	100	120	140	160
22,000	1609	1723	1681	1638	1453	1428	1523	1724	2046	2670
26,000	1793	1948	1872	1796	1582	1536	1621	1812	2134	2731
30,000	1994	2200	2088	1976	1737	1662	1734	1915	2243	2835
34,000	2221	2481	2337	2192	1921	1806	1864	2041	2381	3054
38,000	2473	2806	2636	2466	2129	1976	2015	2196	2558	3371
42,000	2759	3193	3003	2813	2358	2180	2195	2394	2819	3830
46,000	3095	3615	3424	3232	2643	2408	2423	2668	3307	4560
50,000	3463	4073	4012	3951	2991	2668	2696	3019	3905	5575

TABLE 4-19

BASIC FUEL FLOW

FUEL FLOW RATES FOR THE GIVEN CONDITIONS IN LBS/HR

PRESSURE: 8000 FT TEMPERATURE: 15 C

AIRCRAFT - CH-47D

CHINOOK

GROSS WEIGHTS (LBS)	FLIGHT MODE (KTS)									
	HIGE	HOGE	NOE	40	60	80	100	120	140	160
22,000	1659	1780	1723	1675	1490	1457	1539	1716	2003	2553
26,000	1850	2017	1930	1843	1630	1573	1641	1807	2095	2619
30,000	2064	2280	2160	2039	1800	1707	1761	1918	2212	2751
34,000	2303	2583	2433	2282	2000	1864	1901	2055	2363	2988
38,000	2574	2938	2771	2605	2215	2054	2065	2229	2577	3357
42,000	2887	3349	3166	2983	2480	2271	2273	2475	2960	3980
46,000	3245	3802	3713	3624	2808	2520	2533	2798	3520	4946
50,000	3639	4296	4514	4732	3185	2812	2829	3179	4116	6135

TABLE 4-20

BASIC FUEL FLOW

FUEL FLOW RATES FOR THE GIVEN CONDITIONS IN LBS/HR

PRESSURE: 8000 FT TEMPERATURE: 35 C

AIRCRAFT - CH-47D

CHINOOK

GROSS WEIGHTS (LBS)	FLIGHT MODE (KTS)									
	HIGE	HOGE	NOE	40	60	80	100	120	140	160
22,000	1708	1838	1776	1715	1530	1491	1561	1719	1982	2470
26,000	1909	2085	1990	1894	1683	1614	1669	1816	2080	2554
30,000	2135	2363	2236	2110	1869	1758	1798	1937	2206	2727
34,000	2388	2692	2542	2393	2077	1932	1949	2089	2379	3012
38,000	2683	3071	2909	2748	2314	2139	2134	2297	2678	3508
42,000	3018	3509	3380	3251	2623	2371	2374	2593	3176	4351
46,000	3397	3991	4127	4262	2979	2650	2658	2949	3761	5481
50,000	3818	4514	4930	5345	3358	2940	2951	3328	4356	6644

TABLE 4-21

BASIC FUEL FLOW

FUEL FLOW RATES FOR THE GIVEN CONDITIONS IN LBS/HR

PRESSURE: 10000 FT TEMPERATURE: -25 C

AIRCRAFT - CH-47D

CHINOOK

GROSS WEIGHTS (LBS)	FLIGHT MODE (KTS)									
	HIGE	HOGE	NOE	40	60	80	100	120	140	160
22,000	1515	1628	1586	1544	1362	1341	1444	1655	1997	2689
26,000	1697	1853	1777	1700	1491	1451	1545	1747	2094	2786
30,000	1900	2108	1995	1882	1646	1578	1660	1857	2213	2934
34,000	2130	2391	2247	2103	1833	1724	1795	1991	2385	3175
38,000	2383	2729	2554	2379	2046	1899	1952	2155	2597	3529
42,000	2679	3118	2930	2742	2278	2110	2139	2363	2909	4025
46,000	3020	3539	3352	3164	2572	2343	2374	2678	3416	4793
50,000	3389	3992	3935	3878	2935	2617	2664	3066	4042	5847

TABLE 4-22

BASIC FUEL FLOW

FUEL FLOW RATES FOR THE GIVEN CONDITIONS IN LBS/HR

PRESSURE: 10000 FT TEMPERATURE: -5 C

AIRCRAFT - $CH-47_D$

CHINOOK

GROSS WEIGHTS (LBS)	FLIGHT MODE (KTS)									
	HIGE	HOGE	NOE	40	60	80	100	120	140	160
22,000	1563	1684	1631	1579	1395	1364	1449	1631	1927	2494
26,000	1754	1922	1834	1746	1536	1481	1554	1725	2025	2571
30,000	1969	2189	2067	1945	1707	1616	1676	1840	2150	2720
34,000	2213	2496	2345	2194	1909	1775	1819	1985	2311	3017
38,000	2487	2866	2695	2523	2129	1970	1989	2167	2539	3425
42,000	2813	3282	3102	2921	2401	2194	2207	2425	2981	4096
46,000	3179	3737	3664	3591	2742	2450	2475	2767	3572	5080
50,000	3575	4229	4471	4713	3134	2756	2786	3170	4191	6303

TABLE 4-23

BASIC FUEL FLOW

FUEL FLOW RATES FOR THE GIVEN CONDITIONS IN LBS/HR

PRESSURE: 10000 FT TEMPERATURE: 15 C

AIRCRAFT - CH-47D

CHINOOK

GROSS WEIGHTS (LBS)	FLIGHT MODE (KTS)									
	HIGE	HOGE	NOE	40	60	80	100	120	140	160
22,000	1612	1742	1679	1617	1433	1394	1465	1624	1889	2386
26,000	1813	1990	1894	1797	1588	1518	1575	1724	1993	2478
30,000	2041	2274	2145	2016	1776	1664	1706	1848	2127	2666
34,000	2299	2609	2459	2309	1985	1842	1860	2007	2312	2981
38,000	2600	3006	2838	2671	2231	2053	2054	2229	2637	3518
42,000	2949	3451	3341	3231	2549	2294	2304	2539	3174	4423
46,000	3339	3939	4114	4289	2920	2581	2596	2914	3768	5586
50,000	3765	4457	4899	5341	3309	2880	2901	3308	4364	6752

TABLE 4-24

BASIC FUEL FLOW

FUEL FLOW RATES FOR THE GIVEN CONDITIONS IN LBS/HR

PRESSURE: 10000 FT TEMPERATURE: 35 C

AIRCRAFT - CH-47D

CHINOOK

GROSS WEIGHTS (LBS)	FLIGHT MODE (KTS)									
	HIGE	HOGE	NOE	40	60	80	100	120	140	160
22,000	1661	1800	1729	1658	1475	1428	1487	1629	1872	2313
26,000	1874	2060	1956	1852	1644	561	1605	1736	1983	2435
30,000	2114	2365	2232	2100	1845	1720	1746	1874	2132	2670
34,000	2392	2727	2581	2436	2066	1917	1916	2056	2370	3067
38,000	2717	3147	3005	2864	2355	2140	2141	2329	2819	3814
42,000	3086	3620	3694	3769	2703	2410	2417	2675	3395	4896
46,000	3503	4141	4507	4873	3080	2701	2711	3053	3990	6069
50,000	3963	4661	5292	5923	3471	2998	3013	3444	4584	7215

DELTA FUEL FLOW FOR DRAG DATA TABLES

TABLE 4-25

CORRECTION FUEL FLOW LBS/HR FOR EXTERNAL DRAG

PRESSURE: SEA LEVEL TEMPERATURE: -25 C

AIRCRAFT - CH-47D

CHINOOK

		AIR SPEED IN KTS						
		40	60	80	100	120	140	160
DRAG IN SQUARE FEET	50	16	54	128	252	443	741	1214
	100	32	108	257	506	904	1541	2435
	150	48	163	386	764	1380	2358	3657
	200	65	217	516	1030	1887	3176	4878

TABLE 4-26

CORRECTION FUEL FLOW LBS/HR FOR EXTERNAL DRAG

PRESSURE: SEA LEVEL TEMPERATURE: -5 C

AIRCRAFT - CH-47D

CHINOOK

		AIR SPEED IN KTS						
		40	60	80	100	120	140	160
DRAG IN SQUARE FEET	50	15	50	119	235	409	678	1107
	100	30	101	239	471	832	1396	2248
	150	45	151	360	709	1266	2153	3389
	200	60	202	481	952	1717	2919	4530

TABLE 4-27

CORRECTION FUEL FLOW LBS/HR FOR EXTERNAL DRAG

PRESSURE: SEA LEVEL TEMPERATURE: 15 C

AIRCRAFT - CH-47D

CHINOOK

		AIR SPEED IN KTS						
		40	60	80	100	120	140	160
DRAG IN SQUARE FEET	50	14	47	111	220	383	625	1005
	100	28	94	224	441	772	1278	2072
	150	42	141	337	663	1175	1976	3143
	200	56	189	450	888	1586	2691	4214

TABLE 4-28

CORRECTION FU_{FI} FLOW LBS/HR FOR EXTERNAL DRAG

PRESSURE: SEA LEVEL TEMPERATURE: 35 C

AIRCRAFT - $CH-47_D$

CHINOOK

		AIR SPEED IN KTS						
		40	60	80	100	120	140	160
DRAG IN SQUARE FEET	50	13	44	104	206	360	581	919
	100	27	88	210	415	724	1187	1912
	150	40	133	316	624	1097	1821	2923
	200	53	177	422	834	1480	2490	3933

TABLE 4-29

CORRECTION FUEL FLOW LBS/HR FOR EXTERNAL DRAG

PRESSURE: 2000 FT TEMPERATURE: -25 C

AIRCRAFT - CH-47D

CHINOOK

		AIR SPEED IN KTS						
		40	60	80	100	120	140	160
DRAG IN SQUARE FEET	50	15	50	120	235	413	691	1129
	100	30	101	240	471	843	1436	2265
	150	45	152	360	712	1288	2197	3400
	200	60	202	480	960	1760	2957	4535

TABLE 4-30

CORRECTION FU_{FL} FLOW LBS/HR FOR EXTERNAL DRAG

PRESSURE: 2000 FT TEMPERATURE: -5 C

AIRCRAFT - CH-47D

CHINOOK

		AIR SPEED IN KTS						
		40	60	80	100	120	140	160
DRAG IN SQUARE FEET	50	14	47	111	219	381	632	1031
	100	28	94	223	438	775	1302	2092
	150	42	141	335	660	1180	2007	3153
	200	56	188	448	887	1602	2718	4214

TABLE 4-31

CORRECTION FUEL FLOW LBS/HR FOR EXTERNAL DRAG

PRESSURE: 2000 FT TEMPERATURE: 15 C

AIRCRAFT - CH-47D

CHINOOK

		AIR SPEED IN KTS						
		40	60	80	100	120	140	160
DRAG IN SQUARE FEET	50	13	44	104	205	356	583	936
	100	26	88	209	411	719	1191	1929
	150	39	132	314	617	1094	1843	2924
	200	53	176	419	827	1478	2508	3920

TABLE 4-32

CORRECTION FU_{FL} FLOW LBS/HR FOR EXTERNAL DRAG

PRESSURE: 2000 FT TEMPERATURE: 35 C

AIRCRAFT - CH-47D

CHINOOK

		AIR SPEED IN KTS						
		40	60	80	100	120	140	160
DRAG IN SQUARE FEET	50	12	41	98	193	335	542	855
	100	25	83	196	386	674	1106	1780
	150	37	124	295	581	1022	1698	2720
	200	50	166	394	776	1378	2321	3659

TABLE 4-33

CORRECTION FUEL FLOW LBS/HR FOR EXTERNAL DRAG

PRESSURE: 4000 FT TEMPERATURE: -25 C

AIRCRAFT - CH-47D

CHINOOK

		AIR SPEED IN KTS						
		40	60	80	100	120	140	160
DRAG IN SQUARE FEET	50	14	47	111	218	386	644	1050
	100	28	94	223	438	785	1338	2104
	150	42	141	334	663	1202	2045	3159
	200	56	188	447	894	1641	2751	4213

TABLE 4-34

CORRECTION FUEL FLOW LBS/HR FOR EXTERNAL DRAG

PRESSURE: 4000 FT TEMPERATURE: -5 C

AIRCRAFT - CH-47D

CHINOOK

		AIR SPEED IN KTS						
		40	60	80	100	120	140	160
DRAG IN SQUARE FEET	50	13	44	104	203	355	588	959
	100	26	88	208	408	722	1214	1945
	150	39	131	312	614	1099	1870	2930
	200	52	175	416	826	1494	2530	3915

TABLE 4-35

CORRECTION FUEL FLOW LBS/HR FOR EXTERNAL DRAG

PRESSURE: 4000 FT TEMPERATURE 15 C

AIRCRAFT - CH-47D

CHINOOK

		AIR SPEED IN KTS						
		40	60	80	100	120	140	160
DRAG IN SQUARE FEET	50	12	41	97	191	331	543	872
	100	24	82	194	382	670	1110	1793
	150	37	123	292	574	1019	1717	2718
	200	49	164	390	769	1376	2336	3643

TABLE 4-36

CORRECTION FUEL FLOW LBS/HR FOR EXTERNAL DRAG

PRESSURE: 4000 FT TEMPERATURE: 35 C

AIRCRAFT - CH-47D

CHINOOK

		AIR SPEED IN KTS						
		40	60	80	100	120	140	160
DRAG IN SQUARE FEET	50	12	38	91	179	312	505	796
	100	23	77	183	359	627	1030	1656
	150	35	116	275	540	952	1583	2529
	200	46	155	367	722	1283	2162	3401

TABLE 4-37

CORRECTION FUEL FLOW LBS/HR FOR EXTERNAL DRAG

PRESSURE: 6000 FT TEMPERATURE: -25 C

AIRCRAFT - CH-47D

CHINOOK

		AIR SPEED IN KTS						
		40	60	80	100	120	140	160
DRAG IN SQUARE FEET	50	13	44	103	202	359	600	974
	100	26	87	207	408	731	1246	1953
	150	39	131	311	618	1121	1902	2931
	200	52	175	415	832	1529	2557	3909

TABLE 4-38

CORRECTION FUEL FLOW LBS/HR FOR EXTERNAL DRAG

PRESSURE: 6000 FT TEMPERATURE: -5 C

AIRCRAFT - CH-47D

CHINOOK

		AIR SPEED IN KTS						
		40	60	80	100	120	140	160
DRAG IN SQUARE FEET	50	12	41	96	189	330	548	892
	100	24	81	193	379	672	1132	1807
	150	36	122	290	571	1023	1741	2721
	200	48	163	387	769	1393	2353	3635

TABLE 4-39

CORRECTION FUEL FLOW LBS/HR FOR EXTERNAL DRAG

PRESSURE: 6000 FT TEMPERATURE: 15 C

AIRCRAFT - CH-47D

CHINOOK

		AIR SPEED IN KTS						
		40	60	80	100	120	140	160
DRAG IN SQUARE FEET	50	11	38	90	177	308	506	812
	100	23	76	181	355	623	1034	1666
	150	34	115	272	534	948	1599	2525
	200	45	153	362	716	1281	2174	3383

TABLE 4-40

CORRECTION FUEL FLOW LBS/HR FOR EXTERNAL DRAG

PRESSURE: 6000 FT TEMPERATURE: 35 C

AIRCRAFT - CH-47D

CHINOOK

		AIR SPEED IN KTS						
		40	60	80	100	120	140	160
DRAG IN SQUARE FEET	50	11	36	85	167	289	470	741
	100	21	72	170	334	583	959	1540
	150	32	108	256	502	885	1476	2350
	200	43	144	341	671	1194	2013	3160

TABLE 4-41

CORRECTION FUEL FLOW LBS/HR FOR EXTERNAL DRAG

PRESSURE: 8000 FT TEMPERATURE: -25 C

AIRCRAFT - CH-47D

CHINOOK

		AIR SPEED IN KTS						
		40	60	80	100	120	140	160
DRAG IN SQUARE FEET	50	12	40	96	188	335	559	903
	100	24	81	192	379	681	1160	1810
	150	36	121	288	575	1045	1768	2717
	200	48	162	386	774	1424	2375	3623

TABLE 4-42

CORRECTION FUEL FLOW LBS/HR FOR EXTERNAL DRAG

PRESSURE: 8000 FT TEMPERATURE: -5 C

AIRCRAFT - CH-47D

CHINOOK

		AIR SPEED IN KTS						
		40	60	80	100	120	140	160
DRAG IN SQUARE FEET	50	11	38	90	175	307	510	829
	100	22	76	179	352	626	1055	1677
	150	34	113	269	531	953	1620	2524
	200	45	151	359	715	1298	2187	3371

TABLE 4-43

CORRECTION FUEL FLOW LBS/HR FOR EXTERNAL DRAG
PRESSURE: 8000 FT TEMPERATURE: 15 C
AIRCRAFT - CH-47D
CHINOOK

		AIR SPEED IN KTS						
		40	60	80	100	120	140	160
DRAG IN SQUARE FEET	50	11	35	84	164	286	471	756
	100	21	71	168	329	580	964	1548
	150	32	106	252	496	882	1489	2344
	200	42	142	336	666	1193	2022	3139

TABLE 4-44

CORRECTION FU_{FI} FLOW LBS/HR FOR EXTERNAL DRAG

PRESSURE: 8000 FT TEMPERATURE: 35 C

AIRCRAFT - $CH-47_D$

CHINOOK

		AIR SPEED IN KTS						
		40	60	80	100	120	140	160
DRAG IN SQUARE FEET	50	10	33	79	155	268	438	691
	100	20	67	158	310	542	893	1433
	150	30	100	238	466	824	1376	2184
	200	40	134	317	624	1110	1874	2934

TABLE 4-45

CORRECTION FUEL FLOW LBS/HR FOR EXTERNAL DRAG

PRESSURE: 10000 FT TEMPERATURE: -25 C

AIRCRAFT - CH-47D

CHINOOK

		AIR SPEED IN KTS						
		40	60	80	100	120	140	160
DRAG IN SQUARE FEET	50	11	37	89	175	312	522	837
	100	23	75	178	353	634	1079	1676
	150	34	113	268	535	975	1642	2515
	200	45	150	358	721	1325	2204	3355

TABLE 4-46

CORRECTION FUEL FLOW LBS/HR FOR EXTERNAL DRAG

PRESSURE: 10000 FT TEMPERATURE: -5 C

AIRCRAFT - CH-47D

CHINOOK

		AIR SPEED IN KTS						
		40	60	80	100	120	140	160
DRAG IN SQUARE FEET	50	10	35	83	162	286	474	771
	100	21	70	166	326	582	983	1555
	150	31	105	249	494	887	1507	2340
	200	42	140	333	665	1210	2032	3124

TABLE 4-47

CORRECTION FUEL FLOW LBS/HR FOR EXTERNAL DRAG

PRESSURE: 10000 FT TEMPERATURE: 15 C

AIRCRAFT - CH-47D

CHINOOK

		AIR SPEED IN KTS						
		40	60	80	100	120	140	160
DRAG IN SQUARE FEET	50	10	33	78	152	266	439	705
	100	20	66	156	305	540	899	1439
	150	29	99	234	460	820	1387	2175
	200	39	131	312	619	1111	1880	2912

TABLE 4-48

CORRECTION FU_{FI} FLOW LBS/HR FOR EXTERNAL DRAG

PRESSURE: 10000 FT TEMPERATURE: 35 C

AIRCRAFT - $CH-47_D$

CHINOOK

		AIR SPEED IN KTS						
		40	60	80	100	120	140	160
DRAG IN SQUARE FEET	50	9	31	73	143	249	408	646
	100	18	62	147	287	504	831	1335
	150	28	93	220	432	766	1283	2030
	200	37	124	294	580	1033	1745	2724

GROUND IDLE FUEL FLOW DATA TABLE

TABLE 4-49

GROUND IDLE FUEL FLOW
AIRCRAFT - CH-47D
CHINOOK

		PRESSURE ALTITUDE (FT)					
		SEA LEVEL	2000	4000	6000	8000	10000
TEMPERATURE DEGREES CENTIGRADE	-25 C	1480	1400	1280	1188	1104	1040
	-5 C	1468	1368	1268	1176	1092	1028
	15 C	1454	1374	1254	1162	1078	1014
	35 C	1440	1360	1240	1148	1064	1000

ENTRIES ARE AIRCRAFT FUEL FLOW RATES IN LBS/HR

GROSS WEIGHT LIMITS DATA TABLES

TABLE 4-50

GROSS WEIGHT LIMITS
(DUE TO ENGINE)
FOR TAKEOFF CRITERIA #1
100% OF MAXIMUM POWER (HOGE)
AIRCRAFT - CH-47D
CHINOOK

		PRESSURE ALTITUDE (FT)					
		SEA LEVEL	2000	4000	6000	8000	10000
TEMPERATURE DEGREES CENTIGRADE	-25 C	65150	60580	56269	52212	48388	44801
	-5 C	62795	58385	54227	50316	46632	42983
	15 C	57330	53307	49511	45939	42334	39135
	35 C	50606	47053	43703	40221	37174	34312

ENTRIES ARE AIRCRAFT GROSS WEIGHTS IN LBS

STRUCTURAL GROSS WEIGHT LIMIT: 50000 LBS

TABLE 4-51

GROSS WEIGHT LIMITS
(DUE TO TRANSMISSION)
FOR TAKEOFF CRITERIA #1
100% OF MAXIMUM POWER (HOGE)
AIRCRAFT - CH-47D
CHINOOK

		PRESSURE ALTITUDE (FT)					
		SEA LEVEL	2000	4000	6000	8000	10000
TEMPERATURE DECREES CENTIGRADE	-25 C	57126	55735	54329	52928	51493	50060
	-5 C	55645	54261	52881	51464	50053	48627
	15 C	54278	52916	51521	5 127	48725	47247
	35 C	53024	51649	50270	48893	47440	46085

ENTRIES ARE AIRCRAFT GROSS WEIGHTS IN LBS

STRUCTURAL GROSS WEIGHT LIMIT: 50000 LBS

TABLE 4-52

GROSS WEIGHT LIMITS
(DUE TO ENGINE)
FOR TAKEOFF CRITERIA #2
95% OF RATED POWER. VERTICAL RATE OF CLIMB 450 FT/MIN. OGE
AIRCRAFT - CH-47D
CHINOOK

		PRESSURE ALTITUDE (FT)					
		SEA LEVEL	2000	4000	6000	8000	10000
TEMPERATURE DEGREES CENTIGRADE	-25 C	60779	56516	52494	48710	45142	41796
	-5 C	58665	54545	50661	47008	43565	40149
	15 C	53518	49762	46219	42885	39512	36525
	35 C	47168	43856	40734	37479	34637	31967

ENTRIES ARE AIRCRAFT GROSS WEIGHTS IN LBS

STRUCTURAL GROSS WEIGHT LIMIT: 50000 LBS

TABLE 4-53

GROSS WEIGHT LIMITS
(DUE TO TRANSMISSION)
FOR TAKEOFF CRITERIA #2
TRANSMISSION POWER LIMIT. VERTICAL RATE OF CLIMB 450 FT/MIN. OGE
AIRCRAFT - CH-47D
CHINOOK

		PRESSURE ALTITUDE (FT)					
		SEA LEVEL	2000	4000	6000	8000	10000
TEMPERATURE DEGREES CENTIGRADE	-25 C	54936	53697	52409	51114	49811	48471
	-5 C	53617	52345	51076	49785	48465	47159
	15 C	52361	51103	49836	48535	47246	45912
	35 C	51201	49953	48670	47396	46089	44715

ENTRIES ARE AIRCRAFT GROSS WEIGHTS IN LBS

STRUCTURAL GROSS WEIGHT LIMIT: 50000 LBS

TABLE 4-54

GROSS WEIGHT LIMITS
(DUE TO ENGINE)
FOR TAKEOFF CRITERIA #3
100% OF MAXIMUM POWER (HIGE)
AIRCRAFT - CH-47D
CHINOOK

		PRESSURE ALTITUDE (FT)					
		SEA LEVEL	2000	4000	6000	8000	10000
TEMPERATURE DEGREES CENTIGRADE	-25 C	73037	67914	63086	58533	54246	50225
	-5 C	70402	65458	60796	56411	52281	48190
	15 C	64272	59762	55506	51502	47460	43874
	35 C	56732	52748	48993	45089	41674	38465

ENTRIES ARE AIRCRAFT GROSS WEIGHTS IN LBS

STRUCTURAL GROSS WEIGHT LIMIT: 50000 LBS

TABLE 4-55

GROSS WEIGHT LIMITS
(DUE TO TRANSMISSION)
FOR TAKEOFF CRITERIA #3
100% OF MAXIMUM POWER (HIGE)
AIRCRAFT - CH-47D
CHINOOK

		PRESSURE ALTITUDE (FT)					
		SEA LEVEL	2000	4000	6000	8000	10000
TEMPERATURE DEGREES CENTIGRADE	-25 C	64042	62480	60905	59337	57732	56110
	-5 C	62380	60828	59283	57700	56102	54489
	15 C	60847	59323	57764	56187	54598	52970
	35 C	59443	57907	56350	54786	53181	51681

ENTRIES ARE AIRCRAFT GROSS WEIGHTS IN LBS

STRUCTURAL GROSS WEIGHT LIMIT: 50000 LBS

VELOCITY LIMITS DATA TABLES

TABLE 4-56

VELOCITY LIMITS TABLE

(INCLUDING FUEL FLOW RATES)

PRESSURE: SEA LEVEL TEMPERATURE: -25 C

AIRCRAFT - CH-47D

CHINOOK

GROSS WEIGHTS (LBS)	LONG RANGE		MAX CONTINUOUS POWER		MAX POWER (ENGINE)		TRANSMISSION LIMITS		VELOCITY NEVER EXCEED	
	VEL (KTS)	F.F. (LBS/HR)	VEL (KTS)	F.F. (LBS/HR)	VEL (KTS)	F.F. (LBS/HR)	VEL (KTS)	F.F. (LBS/HR)	VEL (KTS)	F.F. (LBS/HR)
22,000	126	2333	173	4539	180	4958	167	4143	160	3721
26,000	128	2465	172	4539	179	4958	166	4143	160	3783
30,000	131	2609	171	4539	177	4958	164	4143	160	3872
34,000	132	2735	169	4539	176	4958	162	4143	160	3956
38,000	133	2856	168	4539	175	4958	161	4143	160	4058
42,000	134	3001	166	4539	173	4958	159	4143	160	4196
46,000	135	3140	162	4539	169	4958	156	4143	160	4391
50,000	133	3256	158	4539	164	4958	153	4143	140	3494

TABLE 4-57

VELOCITY LIMITS TABLE

(INCLUDING FUEL FLOW RATES)

PRESSURE: SEA LEVEL TEMPERATURE: -5 C

AIRCRAFT - CH-47D

CHINOOK

GROSS WEIGHTS (LBS)	LONG RANGE		MAX CONTINUOUS POWER		MAX POWER (ENGINE)		TRANSMISSION LIMITS		VELOCITY NEVER EXCEED	
	VEL (KTS)	F.F. (LBS/HR)	VEL (KTS)	F.F. (LBS/HR)	VEL (KTS)	F.F. (LBS/HR)	VEL (KTS)	F.F. (LBS/HR)	VEL (KTS)	F.F. (LBS/HR)
22,000	131	2393	171	4067	187	4962	173	4206	160	3500
26,000	133	2526	170	4067	186	4962	172	4206	160	3551
30,000	135	2650	169	4067	186	4962	172	4206	160	3601
34,000	136	2761	168	4067	186	4962	171	4206	160	3659
38,000	137	2886	167	4067	185	4962	170	4206	160	3745
42,000	138	3017	163	4067	182	4962	167	4206	160	3881
46,000	138	3157	159	4067	175	4962	161	4206	160	4127
50,000	138	3337	155	4067	168	4962	157	4206	140	3387

TABLE 4-58

VELOCITY LIMITS TABLE

(INCLUDING FUEL FLOW RATES)

PRESSURE: SEA LEVEL TEMPERATURE: 15 C

AIRCRAFT - CH-47D

CHINOOK

GROSS WEIGHTS (LBS)	LONG RANGE		MAX CONTINUOUS POWER		MAX POWER (ENGINE)		TRANSMISSION LIMITS		VELOCITY NEVER EXCEED	
	VEL (KTS)	F.F. (LBS/HR)	VEL (KTS)	F.F. (LBS/HR)	VEL (KTS)	F.F. (LBS/HR)	VEL (KTS)	F.F. (LBS/HR)	VEL (KTS)	F.F. (LBS/HR)
22,000	135	2452	163	3536	186	4593	179	4267	160	3354
26,000	137	2568	163	3536	185	4593	179	4267	160	3397
30,000	140	2708	162	3536	185	4593	178	4267	160	3443
34,000	141	2819	161	3536	185	4593	178	4267	160	3506
38,000	141	2942	158	3536	183	4593	176	4267	160	3611
42,000	141	3078	155	3536	178	4593	171	4267	160	3784
46,000	141	3236	150	3536	170	4593	162	4267	160	4040
50,000	141	3428	144	3536	163	4593	158	4267	140	3395

TABLE 4-59

VELOCITY LIMITS TABLE

(INCLUDING FUEL FLOW RATES)

PRESSURE: SEA LEVEL TEMPERATURE: 35 C

AIRCRAFT - CH-47D

CHINOOK

GROSS WEIGHTS (LBS)	LONG RANGE		MAX CONTINUOUS POWER		MAX POWER (ENGINE)		TRANSMISSION LIMITS		VELOCITY NEVER EXCEED	
	VEL (KTS)	F.F. (LBS/HR)	VEL (KTS)	F.F. (LBS/HR)	VEL (KTS)	F.F. (LBS/HR)	VEL (KTS)	F.F. (LBS/HR)	VEL (KTS)	F.F. (LBS/HR)
22,000	138	2494	157	3090	179	4079	185	4327	160	3246
26,000	141	2625	155	3090	179	4079	185	4327	160	3285
30,000	142	2741	154	3090	179	4079	185	4327	160	3332
34,000	144	2870	151	3090	178	4079	184	4327	160	3411
38,000	144	3006	147	3090	174	4079	180	4327	160	3550
42,000	144	3144	142	3090	167	4079	173	4327	160	3770
46,000	143	3314	135	3090	160	4079	164	4327	146	3410
50,000	140	3509	125	3090	153	4079	157	4327	124	3085

TABLE 4-60

VELOCITY LIMITS TABLE

(INCLUDING FUEL FLOW RATES)

PRESSURE: 2000 FT TEMPERATURE: -25 C

AIRCRAFT - CH-47D

CHINOOK

GROSS WEIGHTS (LBS)	LONG RANGE		MAX CONTINUOUS POWER		MAX POWER (ENGINE)		TRANSMISSION LIMITS		VELOCITY NEVER EXCEED	
	VEL (KTS)	F.F. (LBS/HR)	VEL (KTS)	F.F. (LBS/HR)	VEL (KTS)	F.F. (LBS/HR)	VEL (KTS)	F.F. (LBS/HR)	VEL (KTS)	F.F. (LBS/HR)
22,000	137	2216	173	4220	180	4610	171	4108	160	3483
26,000	130	2363	172	4220	179	4610	170	4108	160	3546
30,000	132	2491	170	4220	176	4610	168	4108	160	3643
34,000	133	2621	168	4220	175	4610	166	4108	160	3736
38,000	134	2750	166	4220	173	4610	164	4108	160	3861
42,000	135	2892	163	4220	170	4610	161	4108	160	4040
46,000	133	3009	159	4220	165	4610	157	4108	160	4296
50,000	133	3170	155	4220	160	4610	153	4108	140	3430

TABLE 4-61

VELOCITY LIMITS TABLE

(INCLUDING FUEL FLOW RATES)

PRESSURE: 2000 FT TEMPERATURE: -5 C

AIRCRAFT - CH-47D

CHINOOK

GROSS WEIGHTS (LBS)	LONG RANGE		MAX CONTINUOUS POWER		MAX POWER (ENGINE)		TRANSMISSION LIMITS		VELOCITY NEVER EXCEED	
	VEL (KTS)	F.F. (LBS/HR)	VEL (KTS)	F.F. (LBS/HR)	VEL (KTS)	F.F. (LBS/HR)	VEL (KTS)	F.F. (LBS/HR)	VEL (KTS)	F.F. (LBS/HR)
22,000	132	2274	170	3781	187	4614	178	4170	160	3274
26,000	135	2414	169	3781	186	4614	177	4170	160	3324
30,000	136	2522	169	3781	186	4614	177	4170	160	3377
34,000	137	2643	167	3781	185	4614	176	4170	160	3449
38,000	138	2769	164	3781	183	4614	173	4170	160	3566
42,000	138	2904	160	3781	176	4614	167	4170	160	3788
46,000	138	3079	156	3781	169	4614	161	4170	160	4082
50,000	138	3274	150	3781	162	4614	156	4170	140	3331

TABLE 4-62

VELOCITY LIMITS TABLE

(INCLUDING FUEL FLOW RATES)

PRESSURE: 2000 FT TEMPERATURE: 15 C

AIRCRAFT - CH-47D

CHINOOK

GROSS WEIGHTS (LBS)	LONG RANGE		MAX CONTINUOUS POWER		MAX POWER (ENGINE)		TRANSMISSION LIMITS		VELOCITY NEVER EXCEED	
	VEL (KTS)	F.F. (LBS/HR)	VEL (KTS)	F.F. (LBS/HR)	VEL (KTS)	F.F. (LBS/HR)	VEL (KTS)	F.F. (LBS/HR)	VEL (KTS)	F.F. (LBS/HR)
22,000	136	2321	163	3288	185	4271	184	4229	160	3135
26,000	139	2450	162	3288	185	4271	184	4229	160	3179
30,000	140	2575	161	3288	185	4271	184	4229	160	3231
34,000	141	2693	159	3288	184	4271	183	4229	160	3316
38,000	141	2825	156	3288	179	4271	178	4229	160	3466
42,000	141	2976	151	3288	172	4271	171	4229	160	3701
46,000	141	3162	145	3288	163	4271	163	4229	145	3278
50,000	137	3335	136	3288	157	4271	156	4229	122	2966

TABLE 4-63

VELOCITY LIMITS TABLE

(INCLUDING FUEL FLOW RATES)

PRESSURE: 2000 FT TEMPERATURE: 35 C

CH'NOOK

GROSS WEIGHTS (LBS)	LONG RANGE		MAX CONTINUOUS POWER		MAX POWER (ENGINE)		TRANSMISSION LIMITS		VELOCITY NEVER EXCEED	
	VEL (KTS)	F.F. (LBS/HR)	VEL (KTS)	F.F. (LBS/HR)	VEL (KTS)	F.F. (LBS/HR)	VEL (KTS)	F.F. (LBS/HR)	VEL (KTS)	F.F. (LBS/HR)
22,000	140	2382	156	2873	179	3793	191	4284	160	3033
26,000	142	2492	155	2873	179	3793	192	4284	160	3074
30,000	143	2615	153	2873	179	3793	192	4284	160	3134
34,000	144	2750	149	2873	175	3793	189	4284	160	3246
38,000	144	2885	144	2873	169	3793	181	4284	160	3439
42,000	143	3047	137	2873	161	3793	172	4284	151	3309
46,000	141	3237	126	2873	154	3793	162	4284	129	2930
50,000	134	3412	109	2873	144	3793	153	4284	106	2853

TABLE 4-64

VELOCITY LIMITS TABLE

(INCLUDING FUEL FLOW RATES)

PRESSURE: 4000 Ft TEMPERATURE: -25 C

[illegible]

CHINOOK

GROSS WEIGHTS (LBS)	LONG RANGE		MAX CONTINUOUS POWER		MAX POWER (ENGINE)		TRANSMISSION LIMITS		VELOCITY NEVER EXCEED	
	VEL (KTS)	F.F. (LBS/HR)	VEL (KTS)	F.F. (LBS/HR)	VEL (KTS)	F.F. (LBS/HR)	VEL (KTS)	F.F. (LBS/HR)	VEL (KTS)	F.F. (LBS/HR)
22,000	128	2112	173	3921	179	4282	176	4078	160	3259
26,000	131	2256	171	3921	177	4282	173	4078	160	3345
30,000	133	2382	169	3921	176	4282	172	4078	160	3430
34,000	134	2508	167	3921	174	4282	170	4078	160	3541
38,000	135	2651	164	3921	171	4282	167	4078	160	3700
42,000	133	2769	160	3921	166	4282	162	4078	160	3937
46,000	133	2925	155	3921	160	4282	158	4078	160	4266
50,000	132	3123	150	3921	156	4282	153	4078	140	3416

TABLE 4-65

VELOCITY LIMITS TABLE

(INCLUDING FUEL FLOW RATES)

PRESSURE: 4000 FT TEMPERATURE: -5 C

AIRCRAFT - CH47A

CHINOOK

GROSS WEIGHTS (LBS)	LONG RANGE		MAX CONTINUOUS POWER		MAX POWER (ENGINE)		TRANSMISSION LIMITS		VELOCITY NEVER EXCEED	
	VEL (KTS)	F.F. (LBS/HR)	VEL (KTS)	F.F. (LBS/HR)	VEL (KTS)	F.F. (LBS/HR)	VEL (KTS)	F.F. (LBS/HR)	VEL (KTS)	F.F. (LBS/HR)
22,000	133	2165	170	3512	186	4285	183	4136	160	3060
26,000	135	2291	169	3512	186	4285	183	4136	160	3111
30,000	137	2403	168	3512	186	4285	182	4136	160	3171
34,000	138	2530	166	3512	184	4285	181	4136	160	3268
38,000	138	2658	162	3512	179	4285	176	4136	160	3433
42,000	138	2826	157	3512	170	4285	168	4136	160	3732
46,000	138	3021	150	3512	163	4285	161	4136	144	3226
50,000	134	3211	143	3512	156	4285	153	4136	122	2888

TABLE 4-66

VELOCITY LIMITS TABLE

(INCLUDING FUEL FLOW RATES)

PRESSURE: 4000 FT TEMPERATURE: 15 C

AIRCRAFT - CH-47D

CHINOOK

GROSS WEIGHTS (LBS)	LONG RANGE		MAX CONTINUOUS POWER		MAX POWER (ENGINE)		TRANSMISSION LIMITS		VELOCITY NEVER EXCEED	
	VEL (KTS)	F.F. (LBS/HR)	VEL (KTS)	F.F. (LBS/HR)	VEL (KTS)	F.F. (LBS/HR)	VEL (KTS)	F.F. (LBS/HR)	VEL (KTS)	F.F. (LBS/HR)
22,000	137	2203	163	3054	185	3967	190	4192	160	2929
26,000	140	2340	162	3054	185	3967	191	4192	160	2974
30,000	141	2453	160	3054	185	3967	191	4192	160	3041
34,000	141	2579	157	3054	181	3967	187	4192	160	3162
38,000	141	2723	152	3054	174	3967	179	4192	160	3369
42,000	141	2901	146	3054	166	3967	170	4192	150	3172
46,000	138	3085	137	3054	157	3967	161	4192	127	2816
50,000	132	3303	125	3054	147	3967	151	4192	105	2747

TABLE 4-67

VELOCITY LIMITS TABLE

(INCLUDING FUEL FLOW RATES)

PRESSURE: 4000 FT TEMPERATURE: 35 C

AIRCRAFT - CH-47D

CHINOOK

GROSS WEIGHTS (LBS)	LONG RANGE		MAX CONTINUOUS POWER		MAX POWER (ENGINE)		TRANSMISSION LIMITS		VELOCITY NEVER EXCEED	
	VEL (KTS)	F.F. (LBS/HR)	VEL (KTS)	F.F. (LBS/HR)	VEL (KTS)	F.F. (LBS/HR)	VEL (KTS)	F.F. (LBS/HR)	VEL (KTS)	F.F. (LBS/HR)
22,000	141	2254	156	2669	179	3523	198	4247	160	2832
26,000	142	2370	154	2669	179	3523	199	4247	160	2878
30,000	144	2500	151	2669	177	3523	198	4247	160	2963
34,000	144	2636	146	2669	172	3523	191	4247	160	3122
38,000	143	2784	139	2669	163	3523	180	4247	156	3211
42,000	142	2970	126	2669	156	3523	169	4247	134	2773
46,000	134	3137	110	2669	145	3523	158	4247	111	2670
50,000	130	3398	0	2669	133	3523	147	4247	89	2803

TABLE 4-68

VELOCITY LIMITS TABLE

(INCLUDING FUEL FLOW RATES)

PRESSURE: 6000 FT TEMPERATURE: -25 C

AIRCRAFT - CH-47B

CHINOOK

GROSS WEIGHTS (LBS)	LONG RANGE		MAX CONTINUOUS POWER		MAX POWER (ENGINE)		TRANSMISSION LIMITS		VELOCITY NEVER EXCEED	
	VEL (KTS)	F.F. (LBS/HR)	VEL (KTS)	F.F. (LBS/HR)	VEL (KTS)	F.F. (LBS/HR)	VEL (KTS)	F.F. (LBS/HR)	VEL (KTS)	F.F. (LBS/HR)
22,000	130	2021	172	3638	179	3974	180	4051	160	3049
26,000	132	2151	170	3638	176	3974	178	4051	160	3142
30,000	133	2273	168	3638	175	3974	176	4051	160	3238
34,000	134	2417	165	3638	172	3974	174	4051	160	3376
38,000	134	2535	161	3638	168	3974	169	4051	160	3587
42,000	133	2685	156	3638	161	3974	162	4051	160	3896
46,000	132	2882	150	3638	156	3974	157	4051	145	3351
50,000	126	2983	143	3638	149	3974	150	4051	122	2878

TABLE 4-69

VELOCITY LIMITS TABLE

(INCLUDING FUEL FLOW RATES)

PRESSURE: 6000 FT TEMPERATURE: -5 C

AIRCRAFT - CH-47D

CHINOOK

GROSS WEIGHTS (LBS)	LONG RANGE		MAX CONTINUOUS POWER		MAX POWER (ENGINE)		TRANSMISSION LIMITS		VELOCITY NEVER EXCEED	
	VEL (KTS)	F.F. (LBS/HR)	VEL (KTS)	F.F. (LBS/HR)	VEL (KTS)	F.F. (LBS/HR)	VEL (KTS)	F.F. (LBS/HR)	VEL (KTS)	F.F. (LBS/HR)
22,000	135	2067	170	3258	186	3977	189	4107	160	2859
26,000	136	2177	169	3258	186	3977	189	4107	160	2912
30,000	137	2299	167	3258	185	3977	188	4107	160	2989
34,000	138	2429	163	3258	181	3977	185	4107	160	3124
38,000	138	2578	158	3258	172	3977	175	4107	160	3388
42,000	138	2770	152	3258	163	3977	166	4107	149	3108
46,000	135	2957	144	3258	156	3977	158	4107	126	2743
50,000	130	3174	132	3258	147	3977	149	4107	104	2667

TABLE 4-70

VELOCITY LIMITS TABLE

(INCLUDING FUEL FLOW RATES)

PRESSURE: 6000 FT TEMPERATURE: 15 C

AIRCRAFT - CH-47D

CHINOOK

GROSS WEIGHTS (LBS)	LONG RANGE		MAX CONTINUOUS POWER		MAX POWER (ENGINE)		TRANSMISSION LIMITS		VELOCITY NEVER EXCEED	
	VEL (KTS)	F.F. (LBS/HR)	VEL (KTS)	F.F. (LBS/HR)	VEL (KTS)	F.F. (LBS/HR)	VEL (KTS)	F.F. (LBS/HR)	VEL (KTS)	F.F. (LBS/HR)
22,000	138	2097	162	2834	185	3681	197	4160	160	2734
26,000	141	2223	161	2834	185	3681	198	4160	160	2786
30,000	141	2342	159	2834	183	3681	197	4160	160	2879
34,000	141	2479	154	2834	177	3681	189	4160	160	3051
38,000	141	2645	148	2834	168	3681	178	4160	154	3071
42,000	140	2849	139	2834	159	3681	168	4160	132	2661
46,000	133	3047	126	2834	149	3681	156	4160	109	2568
50,000	125	3219	108	2834	137	3681	145	4160	87	2718

TABLE 4-71

VELOCITY LIMITS TABLE
(INCLUDING FUEL FLOW RATES)
PRESSURE: 6000 FT TEMPERATURE: 35 C
AIRCRAFT - CH-47D
CHINOOK

GROSS WEIGHTS (LBS)	LONG RANGE		MAX CONTINUOUS POWER		MAX POWER (ENGINE)		TRANSMISSION LIMITS		VELOCITY NEVER EXCEED	
	VEL (KTS)	F.F. (LBS/HR)	VEL (KTS)	F.F. (LBS/HR)	VEL (KTS)	F.F. (LBS/HR)	VEL (KTS)	F.F. (LBS/HR)	VEL (KTS)	F.F. (LBS/HR)
22,000	141	2136	154	2453	178	3236	206	4212	160	2644
26,000	143	2258	152	2453	178	3236	207	4212	160	2704
30,000	144	2393	147	2453	173	3236	203	4212	160	2825
34,000	144	2532	140	2453	165	3236	191	4212	160	3044
38,000	142	2708	130	2453	157	3236	178	4212	139	2616
42,000	135	2868	112	2453	147	3236	164	4212	116	2493
46,000	130	3131	0	2453	133	3236	152	4212	94	2580
50,000	124	3357	0	2453	121	3236	142	4212	71	2968

TABLE 4-72

VELOCITY LIMITS TABLE

(INCLUDING FUEL FLOW RATES)

PRESSURE: 8000 FT TEMPERATURE: -25 C

AIRCRAFT - CH-47D

CHINOOK

GROSS WEIGHTS (LBS)	LONG RANGE		MAX CONTINUOUS POWER		MAX POWER (ENGINE)		TRANSMISSION LIMITS		VELOCITY NEVER EXCEED	
	VEL (KTS)	F.F. (LBS/HR)	VEL (KTS)	F.F. (LBS/HR)	VEL (KTS)	F.F. (LBS/HR)	VEL (KTS)	F.F. (LBS/HR)	VEL (KTS)	F.F. (LBS/HR)
22,000	131	1929	171	3371	177	3683	185	4024	160	2869
26,000	133	2055	169	3371	176	3683	183	4024	160	2955
30,000	134	2184	167	3371	174	3683	181	4024	160	3070
34,000	135	2326	162	3371	169	3683	177	4024	160	3251
38,000	133	2451	157	3371	162	3683	169	4024	160	3531
42,000	133	2647	151	3371	157	3683	161	4024	149	3256
46,000	126	2756	144	3371	149	3683	155	4024	127	2754
50,000	123	3036	133	3371	139	3683	145	4024	104	2623

TABLE 4-73

VELOCITY LIMITS TABLE

(INCLUDING FUEL FLOW RATES)

PRESSURE: 8000 FT TEMPERATURE: -5 C

AIRCRAFT - CH-47D

CHINOOK

GROSS WEIGHTS (LBS)	LONG RANGE		MAX CONTINUOUS POWER		MAX POWER (ENGINE)		TRANSMISSION LIMITS		VELOCITY NEVER EXCEED	
	VEL (KTS)	F.F. (LBS/HR)	VEL (KTS)	F.F. (LBS/HR)	VEL (KTS)	F.F. (LBS/HR)	VEL (KTS)	F.F. (LBS/HR)	VEL (KTS)	F.F. (LBS/HR)
22,000	135	1960	169	3020	186	3685	196	4079	160	2670
26,000	137	2072	168	3020	186	3685	196	4079	160	2731
30,000	138	2200	165	3020	183	3685	194	4079	160	2835
34,000	138	2338	159	3020	175	3685	184	4079	160	3054
38,000	138	2521	155	3020	166	3685	174	4079	153	3019
42,000	136	2708	146	3020	158	3685	164	4079	131	2590
46,000	130	2926	133	3020	148	3685	154	4079	108	2493
50,000	124	3142	120	3020	136	3685	143	4079	86	2647

TABLE 4-74

VELOCITY LIMITS TABLE

(INCLUDING FUEL FLOW RATES)

PRESSURE: 8000 FT TEMPERATURE: 15 C

AIRCRAFT - CH-47D

CHINOOK

GROSS WEIGHTS (LBS)	LONG RANGE		MAX CONTINUOUS POWER		MAX POWER (ENGINE)		TRANSMISSION LIMITS		VELOCITY NEVER EXCEED	
	VEL (KTS)	F.F. (LBS/HR)	VEL (KTS)	F.F. (LBS/HR)	VEL (KTS)	F.F. (LBS/HR)	VEL (KTS)	F.F. (LBS/HR)	VEL (KTS)	F.F. (LBS/HR)
22,000	140	2002	161	2601	185	3385	206	4131	159	2527
26,000	141	2115	159	2601	184	3385	206	4131	159	2595
30,000	141	2244	155	2601	179	3385	201	4131	159	2727
34,000	141	2396	149	2601	170	3385	189	4131	159	2958
38,000	141	2592	141	2601	160	3385	176	4131	137	2503
42,000	134	2774	127	2601	150	3385	162	4131	114	2393
46,000	126	2965	108	2601	137	3385	151	4131	92	2497
50,000	123	3292	0	2601	126	3385	140	4131	69	2920

TABLE 4-75

VELOCITY LIMITS TABLE

(INCLUDING FUEL FLOW RATES)

PRESSURE: 8000 FT TEMPERATURE: 35 C

AIRCRAFT - CH-47D

CHINOOK

GROSS WEIGHTS (LBS)	LONG RANGE		MAX CONTINUOUS POWER		MAX POWER (ENGINE)		TRANSMISSION LIMITS		VELOCITY NEVER EXCEED	
	VEL (KTS)	F.F. (LBS/HR)	VEL (KTS)	F.F. (LBS/HR)	VEL (KTS)	F.F. (LBS/HR)	VEL (KTS)	F.F. (LBS/HR)	VEL (KTS)	F.F. (LBS/HR)
22,000	142	2027	153	2267	178	2989	216	4182	144	2056
26,000	144	2156	149	2267	176	2989	215	4182	144	2153
30,000	144	2292	143	2267	169	2989	205	4182	144	2285
34,000	143	2454	134	2267	159	2989	189	4182	144	2469
38,000	138	2623	117	2267	150	2989	173	4182	122	2317
42,000	131	2859	0	2267	135	2989	158	4182	99	2369
46,000	124	3084	0	2267	122	2989	147	4182	77	2673
50,000	123	3435	0	2267	106	2989	137	4182	0	0

TABLE 4-76

VELOCITY LIMITS TABLE

(INCLUDING FUEL FLOW RATES)

PRESSURE: 10000 FT TEMPERATURE: -25 C

AIRCRAFT - CH-47D

CHINOOK

GROSS WEIGHTS (LBS)	LONG RANGE		MAX CONTINUOUS POWER		MAX POWER (ENGINE)		TRANSMISSION LIMITS		VELOCITY NEVER EXCEED	
	VEL (KTS)	F.F. (LBS/HR)	VEL (KTS)	F.F. (LBS/HR)	VEL (KTS)	F.F. (LBS/HR)	VEL (KTS)	F.F. (LBS/HR)	VEL (KTS	F.F. (LBS/HR)
22,000	132	1836	170	3121	177	3410	190	4000	160	2689
26,000	133	1959	168	3121	175	3410	189	4000	160	2786
30,000	135	2102	164	3121	171	3410	185	4000	160	2934
34,000	133	2224	159	3121	165	3410	178	4000	160	3175
38,000	133	2391	153	3121	158	3410	169	4000	154	3158
42,000	128	2544	145	3121	151	3410	160	4000	131	2620
46,000	124	2787	134	3121	140	3410	150	4000	109	2457
50,000	122	3131	122	3121	129	3410	139	4000	86	2598

TABLE 4-77

VELOCITY LIMITS TABLE

(INCLUDING FUEL FLOW RATES)

PRESSURE: 10000 FT TEMPERATURE: -5 C

AIRCRAFT - CH-47D

CHINOOK

GROSS WEIGHTS (LBS)	LONG RANGE		MAX CONTINUOUS POWER		MAX POWER (ENGINE)		TRANSMISSION LIMITS		VELOCITY NEVER EXCEED	
	VEL (KTS)	F.F. (LBS/HR)	VEL (KTS)	F.F. (LBS/HR)	VEL (KTS)	F.F. (LBS/HR)	VEL (KTS)	F.F. (LBS/HR)	VEL (KTS)	F.F. (LBS/HR)
22,000	136	1859	168	2774	185	3391	204	4053	158	2425
26,000	137	1980	166	2774	184	3391	204	4053	159	2506
30,000	138	2107	161	2774	179	3391	198	4053	158	2650
34,000	138	2276	155	2774	168	3391	183	4053	158	2924
38,000	137	2467	147	2774	159	3391	172	4053	136	2432
42,000	131	2676	134	2774	149	3391	159	4053	113	2322
46,000	124	2883	120	2774	137	3391	148	4053	91	2431
50,000	122	3261	98	2774	126	3391	138	4053	68	2885

TABLE 4-78

VELOCITY LIMITS TABLE

(INCLUDING FUEL FLOW RATES)

PRESSURE: 10000 FT TEMPERATURE: 15 C

AIRCRAFT - CH-47D

CHINOOK

GROSS WEIGHTS (LBS)	LONG RANGE		MAX CONTINUOUS POWER		MAX POWER (ENGINE)		TRANSMISSION LIMITS		VELOCITY NEVER EXCEED	
	VEL (KTS)	F.F. (LBS/HR)	VEL (KTS)	F.F. (LBS/HR)	VEL (KTS)	F.F. (LBS/HR)	VEL (KTS)	F.F. (LBS HR)	VEL (KTS)	F.F. (LBS/HR)
22,000	140	1898	160	2400	184	3128	215	4104	142	1921
26,000	141	2018	157	2400	182	3128	214	4104	142	2024
30,000	141	2158	152	2400	174	3128	202	4104	142	2161
34,000	141	2337	144	2400	163	3128	187	4104	142	2350
38,000	135	2510	130	2400	153	3128	171	4104	119	2219
42,000	127	2721	111	2400	139	3128	156	4104	97	2287
46,000	123	3019	0	2400	127	3128	145	4104	74	2621
50,000	122	3406	0	2400	113	3128	136	4104	0	0

TABLE 4-79

VELOCITY LIMITS TABLE
(INCLUDING FUEL FLOW RATES)
PRESSURE: 10000 FT TEMPERATURE: 35 C
AIRCRAFT - CH-47C
CHINOOK

GROSS WEIGHTS (LBS)	LONG RANGE		MAX CONTINUOUS POWER		MAX POWER (ENGINE)		TRANSMISSION LIMITS		VELOCITY NEVER EXCEED	
	VEL (KTS)	F.F. (LBS/HR)	VEL (KTS)	F.F. (LBS/HR)	VEL (KTS)	F.F. (LBS/HR)	VEL (KTS)	F.F. (LBS/HR)	VEL (KTS)	F.F. (LBS/HR)
22,000	143	1927	151	2091	177	2757	226	4152	127	1697
26,000	144	2062	146	2091	172	2757	221	4152	127	1803
30,000	143	2205	138	2091	162	2757	203	4152	127	1941
34,000	141	2393	124	2091	153	2757	184	4152	127	2139
38,000	132	2598	0	2091	138	2757	166	4152	104	2164
42,000	125	2811	0	2091	124	2757	152	4152	82	2402
46,000	123	3152	0	2091	107	2757	143	4152	0	0
50,000	122	3540	0	2091	0	2757	134	4152	0	0

APPENDIX A

FUNCTIONS FOR CALCULATING BASIC FUEL FLOW

There are four functions that can be used to calculate the basic fuel flow for the CH-47D helicopter. In order to use the functions the following data is needed:

1. Flight Mode
2. Temperature
3. Pressure (altitude)
4. Gross weight

Which of the four functions will be used depends on the flight mode. The first function is for HIGE (Hover In Ground Effect).

$$FF\ (HIGE) = f\ (TEMP,\ ALT,\ GW)$$

The second function is for HOGE (Hover Out of Ground Effect).

$$FF\ (HOGE) = f\ (TEMP,\ ALT,\ GW)$$

The third function is for NOE (Nap of the Earth).

$$FF\ (NOE) = f\ (TEMP,\ ALT,\ GW)$$

The fourth function is for Forward Flight.

$$FF\ (Forward\ Flight) = f\ (AS,\ TEMP,\ ALT,\ GW)$$

The equation for FF (HIGE) is:

$$FF\ (HIGE) = A\ (ALT) + B\ (TEMP) + C\ (GW) + D\ (ALT)(TEMP) + E\ (ALT)\ (GW) + F\ (TEMP)\ (GW) + G\ (ALT)\ (TEMP)\ (GW) + K$$

Where ALT is the altitude, TEMP is the temperature and GW is the gross weight and the constants have the following values:

$A = -8.51641241 \times 10^{-2}$ $\quad$ $E = 2.22266624 \times 10^{-6}$

$B = -4.86896008 \times 10^{-1}$ $\quad$ $F = 1.29911285 \times 10^{-4}$

$C = 4.92503187 \times 10^{-2}$ $\quad$ $G = 1.24717819 \times 10^{-8}$

$D = -3.35153592 \times 10^{-4}$ $\quad$ $K = 7.26439148 \times 10^{2}$

The equation for FF (HOGE) is exactly the same form as FF (HIGE). A new set of values for the constants is used. These values are:

$A = -1.01110599 \times 10^{-1}$ $\quad E = 3.00206256 \times 10^{-6}$

$B = -1.7357367$ $\quad F = 1.87549333 \times 10^{-4}$

$C = 6.12140894 \times 10^{-2}$ $\quad G = 1.28728674 \times 10^{-8}$

$D = -3.09985186 \times 10^{-4}$ $\quad K = 5.33657318 \times 10^{2}$

The equation for FF (NOE) is once again the same as FF (HIGE). The new values for the constants are:

$A = -1.50587233 \times 10^{-1}$ $\quad E = 4.526434 \times 10^{-6}$

$B = -1.10246739$ $\quad F = 1.42132223 \times 10^{-4}$

$C = 5.06138727 \times 10^{-2}$ $\quad G = 5.7886576 \times 10^{-8}$

$D = -1.5675871 \times 10^{-3}$ $\quad K = 7.81281219 \times 10^{2}$

For the Forward Flight modes the form of the equation is:

$$FF = A(AS) + B(AS^2) + C(AS^3) + D(TEMP) + E(GW) + F(ALT) + G(AS^3)(TEMP)$$
$$+ H(AS^2)(TEMP) + I(AS)(TEMP) + J(AS^3)(GW) + K(AS^2)(GW)$$
$$+ L(AS)(GW) + M(AS^3)(ALT) + N(AS^2)(ALT) + O(AS)(ALT) + P(TEMP)(GW)$$
$$+ Q(TEMP)(ALT) + R(GW)(ALT) + S(TEMP)(GW)(ALT) + T$$

Where AS is the air speed in kts and the values of the constants are:

$A = 3.51982651 \times 10$ $\quad K = 1.0347238 \times 10^{-5}$

$B = -3.09267398 \times 10^{-1}$ $\quad L = -1.63565576 \times 10^{-3}$

$C = 1.27171353 \times 10^{-3}$ $\quad M = -7.65445449 \times 10^{-8}$

$D = 1.98561735$ $\quad N = 2.07648868 \times 10^{-5}$

$E = 1.02072795 \times 10^{-1}$ $\quad O = -2.16791593 \times 10^{-3}$

$F = -1.32065834 \times 10^{-2}$ $\quad P = 1.68798098 \times 10^{-4}$

$G = -1.02795551 \times 10^{-5}$ $\quad Q = 6.69514942 \times 10^{-4}$

$H = 2.09566369 \times 10^{-3}$ $\quad R = 1.99734092 \times 10^{-6}$

$I = -1.66309357 \times 10^{-1}$ $\quad S = -1.95552146 \times 10^{-8}$

$J = -1.75265003 \times 10^{-8}$ $\quad T = -3.73753448 \times 10^{2}$

These functions allow anyone with a simple calculator to figure the fuel flow of the aircraft and bypass both looking up the values and interpolating for points in between the data points in the tables.

The above equations calculate the basic fuel flow for the CH-47D helicopter with the following accuracies:

FF (HIGE) - 98.70%

FF (HOGE) - 98.59%

FF (NOE) - 95.89%

FF (Forward Flight) - 97.70%

APPENDIX B

FUNCTION FOR CALCULATING DELTA FUEL FLOW FOR DRAG

The function below will calculate the delta fuel flow for drag for the CH-47D helicopter. Recall from the discussion in chapter three that this value is added to the basic fuel flow value whenever drag is increasing the rate of fuel flow.*

In order to use the function the following data is needed:

1. Air Speed (AS)
2. Equivalent Square Footage of Drag (SQ)
3. Temperature (TEMP) in degrees centigrade
4. Altitude (ALT) in feet above sea level

That is:

$$FF\ (Drag) = f(AS, SQ, TEMP, ALT)$$

The equation for FF (Drag) is:

$$FF\ (Drag) = A(AS) + B(AS^2) + C(AS^3) + D(TEMP) + E(SQ) + F(ALT)$$
$$+ G(AS^3)(TEMP) + H(AS^2)(TEMP) + I(AS)(TEMP) + J(AS^3)(SQ) + K(AS^2)(SQ)$$
$$+ L(AS)(SQ) + M(AS^3)(ALT) + N(AS^2)(ALT) + O(AS)(ALT) + P(TEMP)(SQ)$$
$$+ Q(TEMP)(ALT) + R(SQ)(ALT) + S(SQ)(ALT)(TEMP) + T$$

Where the constants have the following values:

$A = 6.4792161$	$K = -4.31542183 \times 10^{-4}$
$B = -8.06591017 \times 10^{-2}$	$L = 2.06394196 \times 10^{-2}$
$C = 3.90497546 \times 10^{-4}$	$M = -4.42317369 \times 10^{-8}$
$D = 1.44406068$	$N = 6.22385613 \times 10^{-6}$
$E = 1.01491532$	$O = -4.48688865 \times 10^{-4}$
$F = 3.9021607 \times 10^{-2}$	$P = -2.76944218 \times 10^{-2}$
$G = -7.57192623 \times 10^{-7}$	$Q = 3.27169391 \times 10^{-6}$
$H = -4.94291693 \times 10^{-4}$	$R = -2.37633436 \times 10^{-4}$
$I = 5.3072691 \times 10^{-2}$	$S = 8.83288891 \times 10^{-7}$
$J = 6.51110946 \times 10^{-6}$	$T = -3.13400497 \times 10^{2}$

There is no delta fuel flow for drag for HIGE, HOGE or NOE flight.

This equation calculates the delta fuel flow for drag value with an accuracy of 99.66%. It should be noted that in some instances the computed value wiil be negative. If this occurs, zero (Ø) should be used as the value for delta fuel flow.

APPENDIX C

FUNCTION FOR CALCULATING GROUND IDLE FUEL FLOW

The function below will calculate the ground idle fuel flow rate for the CH-47D helicopter. In order to use the function the following data is needed:

1. Temperature (TEMP) in degrees centigrade.

2. Altitude (ALT) in feet above sea level.

That is:

$$FF\ (Idle) = f\ (TEMP, ALT)$$

The equation, for FF (Idle) is:

$$FF\ (Idle) = A(TEMP) + B(ALT) + C(TEMP)(ALT) + D(TEMP^2) + E(ALT^2) + F$$

Where the constants have the following values:

$A = -6.5749985 \times 10^{-1}$ $\qquad$ $D = -1.24999922 \times 10^{-3}$

$B = -5.5428531 \times 10^{-2}$ $\qquad$ $E = 9.99996317 \times 10^{-7}$

$C = -3.00133252 \times 10^{-11}$ $\qquad$ $F = 1.47358652 \times 10^{3}$

This equation calculates the ground idle fuel flow rate with an accuracy of 99.67%.

APPENDIX D

FUNCTIONS FOR CALCULATING GROSS WEIGHT LIMITS FOR TAKEOFF

The functions given below will calculate the gross weight limits for take off for the CH-47D helicopter. Each of the functions is of the same basic form with the values of the constants changing depending on which take off criteria is being used. In all cases the Structural Gross Weight Limit of the CH-47D helicopter is 50,000 lbs.

In order to use the functions the following data is needed:

1. Temperature (TEMP) in degrees centigrade

2. Altitude (ALT) in feet above sea level

That is:

GW (Limit) = f (TEMP, ALT)

The basic equation for GW (Limit) is:

GW (Limit) = A(TEMP) + B(ALT) + C(TEMP)(ALT) + D

For take off criteria #1 the equation must be used twice, once using the engine limit constants and once using the transmission limit constants. For take off criteria #1 the constants for engine limits are:

$A = -2.42597382 \times 10^{2}$ $C = 6.7236441 \times 10^{-3}$

$B = -1.90027168$ $D = 5.98530454 \times 10^{4}$

For take off criteria #1 the constants for transmission limits are:

$A = -6.83533344 \times 10$ $C = 1.63000381 \times 10^{-4}$

$B = -7.02272102 \times 10^{-1}$ $D = 5.53813848 \times 10^{4}$

For take off criteria #2 two checks must also be made. The constants for engine limits, take off criteria #2 are:

$A = -2.27169994 \times 10^{2}$ $C = 6.27400016 \times 10^{-3}$

$B = -1.77408421$ $D = 5.58615874 \times 10^{4}$

For take off criteria #2 the constants for transmission limits are:

$A = -6.22573853 \times 10$ $C = 3.14355532 \times 10^{-6}$

$B = -6.46108568 \times 10^{-1}$ $D = 5.3370751 \times 10^{4}$

Also for take off criteria #3 two checks must be made. The constants for engine limits, take off criteria #3 are:

$A = -2.71991199 \times 10^{2}$ $\quad C = 7.53757352 \times 10^{-3}$

$B = -2.13035914$ $\quad D = 6.71003945 \times 10^{4}$

For take off criteria #3 the constants for transmission limits are:

$A = -7.67364283 \times 10$ $\quad C = 2.02785825 \times 10^{-4}$

$B = -7.88074605 \times 10^{-1}$ $\quad D = 6.20866934 \times 10^{4}$

This equation with the various sets of constants gives results that are 98.36% accurate or better.

APPENDIX E

SHORT DESCRIPTION OF CHINOOK (CH-47D) DATA SOURCE

DRDAV-EQA(A)
SUBJECT: Short Description of CH-47D Performance Data Provided to TRADOC Systems Analysis Activity (TRASANA)

MFR:

1. References:

a. DF to CH-47 MOD PM,from DRDAV-EQ, HOGE performance increase due to equipping the CH-47C with Fiberglass Rotor Blades (FRB) and T55-L-712 Engines-June 1978.

b. Estimated performance data for the CH-47C Helicopter equipped with Fiberglass Rotor Blade and Lycoming T55-L-712 Engines (D210-11345-1) Feb 78.

c. Determination of the Effects of Rotor Blade Compressibility on the Performance of the UH-1F; FTC-TR-65-17..

2. The performance data presented to TRASANA is the result of combining the helicopter power required, engine power available and engine fuel flow characteristics. The CH-47D power required was calculated from a non-dimensional representation of engine power required (coefficient of power) v.s. gross weight (coefficient of thrust) and true airspeed (advance ratio) The non-dimensional power required was obtained from reference 1a and 1b. All performance in ground effect represents a 10 foot skid height. A temperature dependent correction, based on the method outlined in reference 1c, was made to the power required to account for compressibility which could not be accounted for in the non-dimensional representation.

3. The T55-L-712 engine power available to the CH-47D (which was used in combination with the power required to find helicopter take-off and speed limits) was calculated for the various altitude and temperature combinations by the use of the Lycoming T55-L-712 engine specification computer program.

4. The engine fuel flow at a particular altitude and temperature combination was derived from a representative referred fuel flow as a function of referred engine power. The referred fuel flow curve for the T55-L-712 engine was taken from reference 1b and verified by the use of the Lycoming T55-L-712 engine specification computer program. The calculated fuel flows reflect 5% conservatism. A referred parameter is one which is divided by temperature and pressure ratios in order to represent all atmospheric conditions by one function.

5. The never exceed speeds (Vn.e.) were calculated from those shown graphically in reference 1b.

6. The Structural Gross Weight limit of the CH-47D is 50000 lbs.

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A.C.1